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DR-BOB

DEMAND RESPONSE IN BLOCKS OF BUILDINGS
DELIVERABLE: D4.1 IMPLEMENTATION STRATEGIES

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Task Leader: SIEMENS
Task Contributors: TU, R2M, NBK, GRID, DW, FP, SERV, UTCN
This task will build on the work of WP3 tasks and T5.1 to develop the strategies for implementing the solutions selected and integrated in WP3 at the demonstration sites.
It will include detailed schedules to co-ordinate the deployment in tasks 4.2, 4.3, 4.4 and 4.5.
Building on the workshops conducted as part of T2.2 it will involve liaising with the people taking part in the demonstrations to ensure they understand and commit to their role in the demonstrations (awareness and training activities, train the trainer/peer to peer activities), the functionality of the technologies being demonstrated and that they are enrolled into the goals of the DR-BOB project.</td></tr>
<tr><td colspan="3">D4.1 - Implementation strategies (m16)
This deliverable will present the strategies to be used for implementing the solutions integrated in WP3 at the demonstration sites.
The efforts undertaken to liaise with the end users while developing these strategies are described. Finally the report includes schedules for the deployment of equipment and the tests planned to be conducted in tasks 4.2, 4.3, 4.4 and 4.5.</td></tr>
<tr><td>Contribution of partners</td><td colspan="3">Sarah Bull, Stuart Anderson, Sylvia Breukers,
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EXECUTIVE SUMMARY

Purpose

This report aims to describe the strategies followed and the activities undertaken to facilitate the running of Demonstration Scenarios at each of the four DR-BoB Pilot sites; UK (Middlesbrough), France (Anglet), Italy (Brescia), Romania (Cluj Napoca).

The report has two distinct parts; the first is regarding the Technical Implementation, activities required by both the Technical Solution providers and the work required by the Site / Facilities Managers to implement any hardware required to run the scenarios. The second is regarding the process-related activities such as; training, communication, site features that facilitate or constrain the running of the scenarios.

Methodology

A standard approach to both the Technical Implementation and Demonstration Scenario Strategy was employed.

The Technical Implementation follows directly on from the Integration package (WP3). The Integration of the systems was carried out at the Teesside University (UK) site. The solution implemented there established the blueprint for the implementation at the other Pilot Sites.

During the initialisation stage of the DR-BoB project it had been agreed that some of the sites would implement additional energy management equipment. In addition to this during WP2/3 it was identified that an upgrade to existing or additional equipment would be required. The upgrades and installation of the equipment is not within the remit of the project but the implementation of the Technical Solution is dependent upon it.

In order to implement the solution at other sites, assessment was made using the site specific business requirements. The site specific requirements were identified using the Demonstration Scenarios due to be run at the pilot sites which in turn were developed to utilise the equipment that would be in place. Any variations from the blueprint (UK implementation) were to be developed or configured before the implementation could be complete at each of the other sites.

The plan for the Technical Implementation was managed by the Siemens Project Manager (Siemens are T4.1 lead); holding weekly meetings with each of the Technology Solution providers. At the time of writing the Technical Implementation at all sites is still in progress

The process related to Demonstration Scenarios Implementation Strategy is dependent upon the Technical Solution (WP3) and the Demonstration Scenarios (WP2) but also introduces new elements such as participation, engagement and training.

Strategies for communication, training and end-to-end testing were developed. The communication strategy was developed in consultation with DuneWorks, who provided the building blocks for a communication plan and a list of general considerations for partners at pilot sites to take into consideration. The training strategy is based on material prepared by GridPocket and focuses on the Consumer Portal. The end-to-end testing strategy was developed jointly by Siemens and Teesside University and provides a framework for partners at both the Pilot sites and Technology Solution providers. In addition, demonstration activities

and the staffing required to run the demonstrations successfully are being identified in outline schedules, which are based on templates provided by Siemens.

A high-level extract of the T4.1 project plan can be found in Appendix E: T4.1 Gantt Chart

<u>Key Findings and Conclusions</u>

Using a standard approach to Technical Deployment was possible as the same elements were deployed for each site. Differences meant that that the solution had to be modified:

- Level of automated control allowed at each site
- Variations in demonstration scenarios
- Building use / types of occupants

The variables that need to be managed, in order to run the demonstrations successfully, were only exposed through consultation with partners at Pilot sites. Because the technical solution is the result of an innovation action, none of the partners at Pilot sites had any experience of operating such a solution. It was necessary to refine implementation strategies iteratively.

<u>Lessons Learned</u>

Due to the 'research' nature of the project ideas and methodologies have evolved and continue to evolve.

If a Commercial Business Model were to be developed from this project (see D2.4 Business Models) the following would be in place:

- A standard offering would be agreed prior to any development or configuration being undertaken. This would ensure that the solution was the right fit for the customer and site.
- A standard approach to Business Requirements gathering would be followed to ensure that the solution could be developed in a timely and cost effective manner.

As these standardised elements are not in place implementation of the Technical Solution is taking longer than expected.

Contents

Acronyms and Abbreviations

All acronyms and abbreviations (AAs) used in the report are listed in alphabetical order in the table below (other than symbols for units of measurement):

Term	Explanation
AA	Acronyms and Abbreviations
BoB	Blocks of Buildings
CP	Consumer Portal
CSV	Comma Separated Variable
DEMS	Distributed Energy Management System
DNO	Distribution Network Operator
DoA	Description of Action
DR	Demand Response
DR-BoB	Demand Response in Blocks of Buildings
DREG	Distributed Renewable Energy Generation
DSM	Demand Side Management
DW	DuneWorks
EMS	Energy Management System
EPC	Energy Performance Contract
ESCo	Energy Service Company
ESCo Platform	Now known as Market Emulator, see D3.3 for full explanation
FPH	Fondazione Poliambulanza (a hospital)
FTP	File Transfer Protocol
LEM	Local Energy Manager
ME	Market Emulator
SSM	Supply Side Management
TSO	Transmission System Operator
TU	Teesside University
UTCN	Universitatea Tehnica din Cluj-Napoca[2]
VA	Virtual Asset
VPN	Virtual Private Network
WP	Work Package

[2] Technical University of Cluj-Napoca (Cluj-Napoca is Romania's second largest city after Bucharest)

Glossary

Demand response (DR) provides an opportunity for consumers to play a significant role in the operation of the electric grid by reducing or shifting their electricity usage during peak periods in response to time-based tariffs or other forms of financial incentives.

Demand Side Management (DSM) is commonly used to refer to demand side electrical load management. It involves actions that influence how much energy is used or when energy is used. The goal of DSM is to encourage users to use less energy during peak hours, or to move the time of energy use to off-peak times such as night-time and weekends.

Distribution Network Operators (DNOs) are often also referred to as Distribution System Operators (DSO). They are responsible for the transport of electricity at a regional level and as such they transport electricity at gradually reducing voltages from national grid supply points to final customers, both residential and none residential. Throughout the EU, electricity distribution is a regulated monopoly business.

Dynamic electricity tariffs often referred to as real-time pricing. Prices change usually on an hourly basis reflecting the cost of generating and/or purchasing electricity at the wholesale level at the time of delivery.

Distributed renewable energy generation (DREG) or local, decentralized renewable energy production involves solar photovoltaic (PV), small hydroelectric, small-scale biomass facilities, and micro-wind.

Energy performance contract (EPC) is a contractual arrangement between the beneficiary and the provider of an energy efficiency improvement measure, verified and monitored during the whole term of the contract, where investments (work, supply or service) in that measure are paid for in relation to a contractually agreed level of energy efficiency improvement or other agreed energy performance criterion, such as financial savings.

Energy Supply Contract, the key element in this type of contract is the efficient supply of energy. The contracting partner provides products/services such as supplying electricity, gas, heat. Financing, engineering design, planning, constructing, operation and maintenance of energy production plants as well as management of energy distribution are often all included in the complete service package. For example district heating providers are is the most widely implemented example of energy supply contracting in the residential sector.

Electrical Load management, often referred to as simply load management, is achieved through controlling the power flow in the electric system at the generating end (supply side management) or the customer end (demand side management).

Electricity Supply is the process of buying electricity in bulk and selling it on to the final customer. Electricity supply in most EU counties is a competitive market.

Energy Suppliers buy electricity and /or gas in bulk and sells it to final consumers.

Energy Service Company (ESCO) is a company that offers energy services which may include implementing energy-efficiency projects (and other sustainable energy projects). The energy services supplied by ESCOs can include a wide range of activities such as energy analysis and audits, energy management, project design and implementation, maintenance and operation, monitoring and evaluation of savings, property/facility management, energy and/or equipment supply, provision of service (space heating/cooling, lighting, etc.) advice and training,

Implicit Demand Response. See Time-based pricing

Local renewable energy sources includes solar PV, wind and hydro power, as well as other forms of solar energy, biofuels and heat pumps (ground, rock or water) that is generated within 100 kilometres of the neighbourhood.

Pilot site is a collective term given to the BoB participating in the demonstration of the DR-BoB solution within national boundaries. There are four pilot sites for the demonstration: one in the UK, one in France, one in Italy and one in Romania.

Private wire networks are local electricity grids that although connected to the local distribution networks that are privately owned.

Supply Side Management (SSM) is commonly used to refer to supply side electrical load management. It refers to actions taken to ensure that energy generation, transmission distribution and storage are conducted efficiently, on the supplier's side of the energy supply chain.

Time-based pricing is a pricing strategy where the provider of a service or supplier of a commodity, may vary the price depending on the time-of-day when the service is provided or the commodity is delivered. Therefore dynamic electricity tariffs are a form of time-based pricing. The rational background of time-based pricing is expected or observed change of the supply and demand balance during time.

Time of Use. See Time-based pricing

Transmission network operators (TNOs) are responsible for the bulk transport of electricity by high voltage power lines from power stations to grid supply points. The transmission system is generally referred to as the national grid. Throughout the EU Transmission is a regulated monopoly business.

Utilities industry in its broad sense refers to electricity, gas and water supply companies and integrated energy service providers. The term is most often used to refer to the companies involved in the generation, transmission and distribution of energy.

1 INTRODUCTION

1.1 AIMS AND OBJECTIVES

The aim of Task 4.1 (T4.1) was to create and execute implementation strategies in order that the Demonstration Scenarios (details of which can be found in D2.2) could be run at each of the Pilot Sites. The aim of this report is to describe the work undertaken

This document, is split into two distinct parts (Sections 2 & 4). The first part describes the Strategy and activities associated with the implementation of the Technical Solution at the Pilot Sites and is entitled 'Technical Implementation Strategy'. The second part describes the Strategy and process-related activities, such as; training, communication, site features that facilitate or constrain the running of the scenarios and is entitled 'Demonstration Scenarios Implementation'.

Technical Implementation Objectives (part 1) :

- Implement each of the Technical Solution elements for all of the sites
- Ensure that the Technical Solution works in conjunction with the site specific technical infrastructure
- Ensure that the Technical Solution supports the Demonstration Scenarios (D2.2) at each site.

Demonstration Scenarios Implementation Objectives (part 2) :

- To create a structure that will ensure that there is a consistency of approach to running the Demonstration Scenarios across all sites
- To ensure that the Pilot Sites have the knowledge and understanding that will enable them to run the Demonstration Scenarios
- To ensure that the Pilot Sites have the toolkit available to run the Demonstration Scenarios

1.2 CONTRIBUTION OF THE PROJECT PARTNERS

The following is a description of the partners' contributions to this report:

1.2.1 CSTB

CSTB contributed by attending some workshops, allowing them to remain informed about the strategies.

1.2.2 DUNEWORKS

DuneWorks (DW) worked with pilot sites to develop a communication strategy, which would be used in the build-up to and during the demonstration of the DR-BoB solution.

1.2.3 FONDAZIONE POLIAMBULANZA

As the consortium partner responsible for the Italian pilot site, Fondazione Poliambulanza Hospital (FPH) assisted with the refinement of strategies and adopted the tools and strategies produced by Task 4.1.

1.2.4 GRIDPOCKET

As the consortium partner responsible for the Consumer Portal technology, GridPocket provided:

- description of Consumer Portal pre-requisites for implementation and site specific implementation activities
- guidance on the features and functions of the Consumer Portal that would support building occupant engagement with the DR-BoB solution.

1.2.5 NOBATEK

As the consortium partner responsible for the Market Emulator (or ESCO Platform, see Glossary) Nobatek, (NBK) provided:

- description of Market Emulator pre-requisites for implementation and site specific implementation activities

As the consortium partner responsible for the French pilot site, Nobatek (NBK) assisted with the refinement of strategies and adopted the tools and strategies produced by Task 4.1.

1.2.6 R2M

As the consortium partner working in conjunction with Fondazione Poliambulanza, the partner responsible for the Italian site, R2M provided site pre-requisites and successful implementation criteria for the Technical Implementation.

1.2.7 SIEMENS

As the consortium partner responsible for Task 4.1, Siemens led the development of the deployment plan and facilitated the development of the implementation strategies.

1.2.8 SERVELECT

As the consortium partner working in conjunction with Universitatea Tehnica Cluj-Napoca (UTCN), the partner responsible for the Romanian site, Servelect provided site pre-requisites and successful implementation criteria for the Technical Implementation.

1.2.9 TEESSIDE UNIVERSITY

As the consortium partner responsible for the first pilot site to operate the DR-BoB solution, Teesside University (TU) provided early input into the development of implementation strategies, assisting with the refinement of those strategies. TU also adopted the tools and strategies produced by Task 4.1.

1.2.10 UNIVERSITATEA TEHNICA CLUJ-NAPOCA

As the consortium partner responsible for the Romanian pilot site, Universitatea Tehnica Cluj-Napoca (UTCN) assisted with the refinement of strategies and adopted the tools and strategies produced by Task 4.1.

1.3 RELATIONS TO OTHER ACTIVITIES IN THE PROJECT

The following diagram illustrates the relationship that T4.1 has with other Work Packages and Tasks

The tasks to the left of the diagram are those that T4.1 is dependent upon and those to the right are those that are dependent on Task 4.1

The tasks on the left are the Demonstration Scenarios and the elements of the Technical Solution. The elements of the Technical solution were introduced in Task 2.3 and have been further configured and enhanced during tasks T3.1 - 3.4, The tasks on the right are the running of the Demonstration Scenarios. Work Package 5 ‘Evaluation and Analytics’ has a feed into the running of the Demonstration Scenarios, to ensure that the output can be analysed and evaluated and receives the output once the demonstration scenarios have been run.

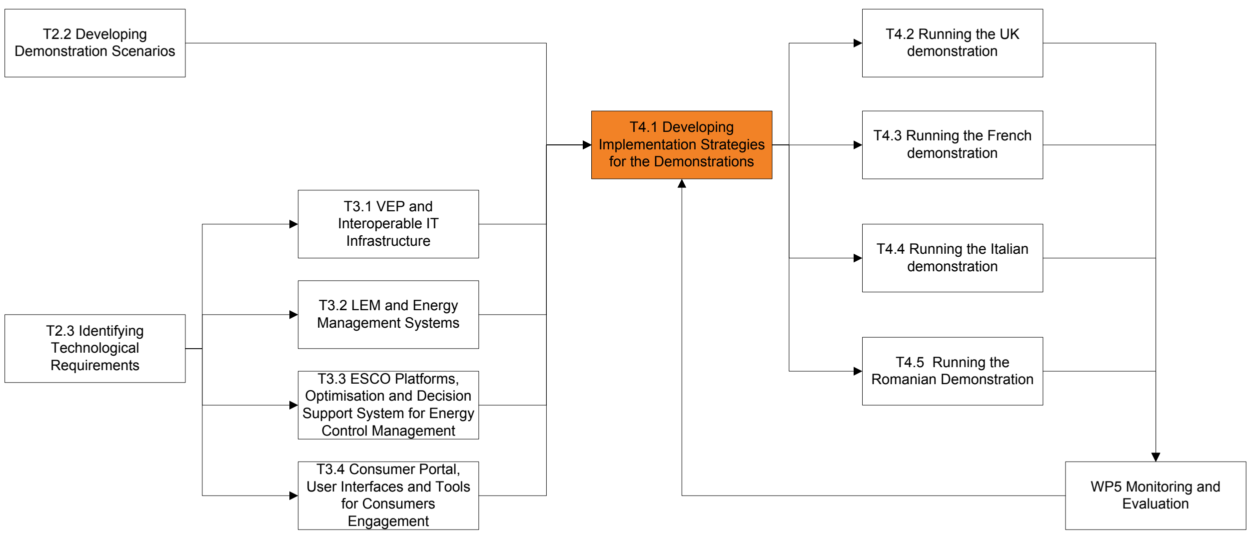


Figure 1: Task 4.1 Developing Implementation Strategies for the Demonstrations

1.4 REPORT STRUCTURE

The report contains two complementary elements; Technical Implementation Strategy and Demonstration Scenarios Implementation Strategy

The first section describes the Strategy and activities associated with the implementation of the Technical Solution at the Pilot Sites and the dependency on the Site Specific equipment that is to be installed.

The second section describes the Strategy and process related activities such as; training, communication, site features that facilitate or constrain the running of the scenarios.

Both sections detail the pre-requisites required before the strategies could be implemented and the success criteria following implementation of the strategies.

2 Technical Deployment Strategy

This section of the report demonstrates how the elements of the Technical Solution described in WP3 deliverables are deployed to complete the end to end Technical solution for each of the Pilot Sites (see §3 Technical Deployment Model).

The aim is to describe the implementation activities identifying any differences in implementation for each of the sites.

For this section of the report it would be useful if the reader was familiar with the Technical elements described below and if not may find it useful to refer to the deliverables (e.g. D3.1) mentioned below.

The four elements of the DR-BoB Technical Solution are:

- Market Emulator – see D3.3 ESCO Platforms, Optimisation and Decision support system for energy control management
- DEMS – see D3.1 VEP and Interoperable IT infrastructure
- Consumer Portal - see D3.4 Consumer Portal
- LEM – see D3.2 LEM and Energy management systems

The four DR-BoB pilot sites are:

- UK - Teesside University (Middlesbrough)
- France – Nobatek and other buildings (Anglet)
- Italy - Fondazione Poliambulanza (Brescia)
- Romania - Universitatea Tehnica Cluj-Napoca (Cluj-Napoca)

Subsequent sections of the report will describe; the prerequisites for the deployment of the solution (§2.1), the site specific deployment requirements and tasks (§2.2)

2.1 PRE-REQUISITES FOR TECHNICAL DEPLOYMENT

Before the end to end Technical Solution could be deployed at each of the Pilot Sites specific activities needed to take place, integrating previous work packages with planning activity of Task 4.1

This pre-requisites section is in two parts; the first (§2.1.1 – Technical Solution Prerequisites) provides a brief description of the work undertaken in WP3 – Integration, by the Technology providers for the UK (Middlesbrough) site prior to implementation across the other three sites. The second (§2.1.2) is a description of the site specific work that needed to be undertaken by the Pilot Site managers to ensure that the Demonstration Scenarios could be supported and that Technical Solution could be implemented.

For a view of activities regarding the Technical Implementation see Appendix E: T4.1 Gantt Chart

2.1.1 TECHNICAL SOLUTION PREREQUISITES

2.1.1.1 *CONTEXT FOR DETERMINATION OF PRE-REQUISITES (UK PILOT SITE)*

The UK site was used as a pilot for the Integration (WP3) phase of the project. As each of the elements of the solution were developed or configured they were prototyped and trialled using the UK site infrastructure and demonstration scenarios as a test case.

The following is a summary of what was developed / configured for the various elements of the Technical Solution the design can been seen in Figure 2: Middlesbrough Pilot Site Configuration

2.1.1.2 *MARKET EMULATOR*

2.1.1.2.1 DEPLOYMENT

A single Market Emulator has been developed to support the functionality required for each of the Pilot Sites. It resides on a server in the Nobatek (Anglet) office.

2.1.1.2.2 FUNCTIONALITY

The following functionality has been developed as part of Integration and is common across all sites:

- Demand Response Event Generation Functionality
    - When a Demand Response market exists (e. g. like in France with capacity market), the Market Emulator acts as an interface to that market, taking the actual events as inputs
    - When a Demand Response market exists but no explicit signal can easily be collected (e. g. like in UK for Triads), the Market Emulator then collects national peak demand automatically and uses a Critical Peak Pricing Black Box (CPPBB) algorithm to simulate Demand Response event;
    - Otherwise a probabilistic approach based on weather forecast with the help of the LEM (e.g. like in France scenario 3 woodchips promotion) or probabilistic generation based on historical peak demand data with the help of the CPPBB algorithm (e.g. like in UK STOR) is used to simulate DR event.

- Weather Forecast Functionality
    - Weather forecast data for all Pilot Sites is collected from The Norwegian Meteorological Institute (MET Norway) under CC BY 3.0: license.
    - The data is made available for use by the LEM and the Consumer Portal

DR events specific to the UK demonstration (described in D3.3) site create an event that is generated to DEMS and have been configured as follows:

- Scenario 1: STOR DR programme – python scripts implemented, as per D3.3, to generate events with probability, timing and duration to match STOR.
- Scenario 2: DTU DR programme – python scripts implemented, as per D3.3, to generate events with probability, timing and duration to match STOR.
- Scenario 3: CPP (TUoS Triads) DR programme – Critical Peak Pricing Black Box (CPPBB) executable developed by TU and implemented by NBK to follow real time UK rolling system demand and issue warnings of likely triad periods with 24 hours and 6 hours notice.

2.1.1.2.3 INTERFACES

The following Interfaces have been developed during the Integration phase of the project.

- To DEMS - generates DR events
- With Consumer Portal - allows the consumer portal to access to weather data
- With LEM – allows the LEM access to weather data

The DEMS and Consumer Portal interfaces will require no changes for deployment to the Pilot Sites. However, as there will be a different instance of the LEM for each Pilot Site, this will be addressed in §2.2 under a sub-section dedicated to the LEM (i.e. §2.2.1.4 for the French Pilot Site, §2.2.2.4 for the Italian Pilot Site and §2.2.3.4 for the Romanian Pilot Site).

2.1.1.3 *CONSUMER PORTAL*

2.1.1.3.1 DEPLOYMENT

The Consumer Portal exists in 3 parts which are deployed in the cloud. The first one called “Building Managers Consumer Portal” is designed for Building Managers (BM). The second one called “Public Portal” is for Buildings Occupants. The third one called “Wall”, which is a more user friendly version of the “Public Portal” is designed to be animated and to draw attention of Buildings Occupants.

Data that will be displayed is collected from DEMS by scripts and processed in the format that suits the Consumer Portal database storage. These scripts are running on a cloud-based machine.

The Consumer Portal requires credentials (email and password) for authentication to access data. These credentials are initially created and provided by GridPocket and sent to the BM. Passwords can be modified once connected to the Consumer Portal.

2.1.1.3.2 FUNCTIONALITY

The main functionally implemented in the solution is:

- Energy Manager notification at event creation - When new event is created on DEMS, Consumer Portal notifies the Building Managers (BM) concerned depending on the scenario. The email received by Building Manager contains: name, start time, and duration of the event and also contains link to Consumer Portal for more information and settings.
- Information about forthcoming events - In addition to events information contained in the notification email, Consumer Portal displays assets participating to the event and configure this event participation.
- Weather forecast - In order assist the Building Manager to make the appropriate decision at the time of a DR event the Consumer Portal displays the weather forecast.
- Opt-out functionality - A Building Manager can opt out (remove from an event) an asset at the time that it happens. They can also opt out assets by default and disable the 'opt out' later.
- Results - The Consumer Portal calculates, through metering available in DEMS, the amount of energy saved during each event. The results are displayed in three ways: event savings, site savings, buildings and scenarios savings. On the Public Portal, only scenario 3 results need to be displayed.
- Forecast and real consumption - Displaying consumption evolution of specified assets and their consumption forecast help Building Managers taking their decision about DR events participation. It enables also to be aware of the consumption
- Time of use - Time of Use tariff periods or 'Implicit DR events' are displayed on the Consumer Portal, in order that high consumption can be avoided during these periods.
- Public portal & Wall - This interface dedicated to Building Occupants displays coming event information (program name, start time, duration, and comments if needed), weather forecast, metering and forecast, participation results. It also enables to BO to give their feedback to BM about DR events. These feedbacks could be seen on the Consumer Portal by BM.

2.1.1.3.3 INTERFACES

Technical implementation of the Consumer Portal (CP) functionality requires working interfaces with DEMS and Market Emulator.

- Consumer Portal and DEMS connectivity is through a secure VPN tunnel using OpenVPN technology. The benefit of using OpenVPN is its simple setup on the server (DEMS) and client (CP) side.

  Note: OpenVPN connection drops after an interval of time. To avoid the dropping of this connection a supervisor has been implemented on CP side to restart OpenVPN connection when it stops. Before accessing data, authentication is required using username and password previously provided.
- CP retrieves from DEMS all information about DR events using REST protocol over HTTP. Data gathered is; forthcoming DR events planned, participating (in DR event) assets, opt out (not participating assets), recommendations of action to take for an event (at site or asset level), Time of Use (ToU), results (of participating assets), metering data and forecast data.

- CP retrieves weather forecast and any other required data from the Market Emulator using a REST protocol over HTTP.
- User Access to Consumer Portal. The following are links to the UK view of the portal for both Building Managers and Building Occupants

  Link to access the CP is: http://uk.dr-bob-portal.eu

  Link to access the Public Portal is: http://uk.dr-bob-portal.eu/publicportal

  Link to access the Animated Portal is: http://uk.dr-bob-portal.eu/wall

2.1.1.4 *DEMS*

2.1.1.4.1 DEPLOYMENT

There is one instance of DEMS which has been deployed to a single Linux VM on the AWS Cloud-service.

2.1.1.4.2 FUNCTIONALITY

DEMS 4.0 is an existing Siemens product that has been implemented as part of the DR-BoB Technical solution.

Its primary purpose is to enable common configuration of programmes, virtual assets, meters, channels, baselines, time-bands and more. DEMS is also used to act as a persistent store of readings and other collected data from the sites via the LEM. As well as providing configuration and data storage, it is the responsibility of DEMS to route the DR Events from any source to the right LEM configuration at the right site. DEMS will facilitate the passing of recommendations generated by the LEM to the CP for dissemination to the appropriate FMs and consumers. Finally, DEMS will provide all this data and configuration to the E&A at regular intervals, i.e. daily or when it changes.

The DEMS implementation for the DR-BoB project only makes use of standard elements of the data structure and existing processes, there is no customisation. Each site is set up a single customer with multiple premises, SDPs etc.

The following is the data / configuration required for each Pilot Site with specific examples for the UK site:

- Creation of one DR Programme for each of the Demonstration Scenarios 1, 2, 3a and 4.
- Creation of Service Delivery Points / Virtual Assets; Tower Electricity Import, Tower Boilers, Backup Generator, UPS, CHP, Tower HVAC, Stephenson Electricity Consumption, Stephenson HVAC, General Areas - Set Point Override Enable, Temp Sensor - General Areas Average, Temp Sensor – HighestSouthQuadTemp, Clarendon Electricity Consumption, General Areas Chiller 1, General Areas Chiller 2, Heating and Ventilation Panel, Existing Heating and Ventilation Panel, Lecture Theatre Chillers, HVAC Electricity, Clarendon Users Electricity, Constantine Electricity Consumption, Constantine HVAC, Constantine Heat, Electric Vehicle Chargers, Phoenix Electricity, RIS Office Electricity, Main Site Electricity
- Creation of Meters records (electricity, gas, heat) and association with a Service Delivery Point / Virtual Asset as above.
- Creation of channels against the meters which will hold the following data; Electricity; (Import, Export and Generation), heat and gas metering, internal and external

temperatures, heat and electricity forecasts, recommendations for manual assets to the end consumer via the Consumer Portal

- A Customer Premise Equipment (CPE) entity (configured with the communication details) for each scenario, this enables the LEM at the site to receive notification of the DR event.
- ToU time-band entities according to the following:

Band	Price p/kWh	Days of Week	Start	End
Green	7.038	Mon-Fri	00:00:00	08:00:00
Amber	7.374	Mon-Fri	08:00:00	16:00:00
Red	14.839	Mon-Fri	16:00:00	19:30:00
Amber	7.374	Mon-Fri	19:30:00	22:00:00
Green	7.038	Mon-Fri	22:00:00	23:59:00
Green	7.038	Sat-Sun	00:00:00	23:59:00

2.1.1.4.3 *INTERFACES*

Interfaces with the following systems have been configured (for further details see D3.1):

Market Emulator - to receive notification of DR events

Consumer Portal - to allow presentation of data to the Consumer Portal Users (see D3.4 for further details) and to allow users (Facilities Managers) to opt out (make assets unavailable)

The LEM - to push notification of events and receive meter data

2.1.1.5 *THE LEM (INCL. HARDWARE)*

2.1.1.5.1 *DEPLOYMENT*

The LEM is the interface between the DR-BoB Technical Solution and the assets at the Pilot Sites. For this reason there are four instances of the LEM

The instance of the LEM for the UK is located on a PC in the research offices of the Phoenix Building and installed within a Linux environment.

2.1.1.5.2 *FUNCTIONALITY*

In WP3 the LEM software has been developed and integrated with the other elements of the DR-BOB technical solution. The following general prerequisites have been fulfilled in order to achieve technical implementation.

- Collect weather data. The LEM is able to ingest temperature (in degrees Celsius) and cloudiness (%) data from the ME.
- Maintain a site asset model, structure and parameters. The LEM’s modular software structure is configurable for each of the Pilot Sites when provided with techno-economic parameters for the assets under control and the site energy supply.
- Predictive model control to optimize asset operation. Supervisory feedback algorithms have been implemented to optimize asset operation at minimal cost, energy consumption, peak power demand in response to demand response signals.

- Ingest DR event signals. The solution ingests DR requests from DEMS in proprietary and OpenADR format. Asset availability, power, time and duration of DR request are then interpreted for predictive model control.
- Collect energy consumption and decentralised generation data. The LEM captures metered consumption data for all vectors at the appropriate time intervals, and availability and power output from metered decentralised generation assets.
- Store energy consumption data. The LEM holds a current record of energy consumption data (all vectors).
- Remote maintenance. The LEM software can configured offline or remotely via a secure internet connection.
- Predictions. The LEM provides predictions of future energy consumption and generation to DEMS on all meter channels for visualization in the CP.
- Implement predictive model control (automated pathway). The LEM is able to dispatch assets in accordance with its optimisation function and DR signals from DEMS.
- Communicate asset recommendations (manual pathway). Recommendations for asset dispatch are communicated to CP via DEMS in accordance with the LEM's optimisation function.

Pass through meter readings. The LEM sends site meter readings (energy and temperature) to DEMS at the appropriate time interval and aggregation level.The LEM has been configured to meet the following site specific requirements:

- Simulate CHP response: the LEM modifies meter readings passed to DEMS to simulate the participation of the CHP plant in Scenario 2
- Monitor and respond to grid frequency: the LEM monitors local grid frequency on a sub-second basis responding when a defined threshold is reached (49.7Hz in the first instance).
- Simulate Backup Generator (BG) and Uninterruptible Power Supply (UPS) response: the LEM modifies meter readings passed to DEMS to simulate the participation of the BG+UPS plant in Scenario 4 in response to grid frequency deviations.

2.1.1.5.3 *INTERFACES*

- Communications. The LEM has connectivity options to DEMS, metering systems, BMS and the internet.
- Security. The LEM implements OpenVPN secure communication protocol.

2.1.1.6 *CONNECTIVITY*

OpenVPN provides individual secure Virtual Private Network (VPN) connectivity between DEMS and the other DR-BoB components. This ensures a secure platform to platform connection, thus providing an extra level of security to the subsystem platforms and the sites.

FTP over Secure Shell (SFTP) for secure data transfer of reading and generation data from each LEM at each site, and also for DEMS to send data extracts to CSTB for the Evaluation & Analytics.

All the software components described above have been deployed to a single VM running Linux. Access to the VM is provided via a Virtual PC, one VPC instance has been made available to each person granted access to the DEMS VM. This ensures that there are no shared usernames and passwords to access the platform.

2.1.1.7 *EVALUATION AND ANALYTICS PLATFORM*

Data required for Evaluation and Analytics will be transferred via ftp to a server at a CSTB location. See D4.3 'Evaluation Data' for further details.

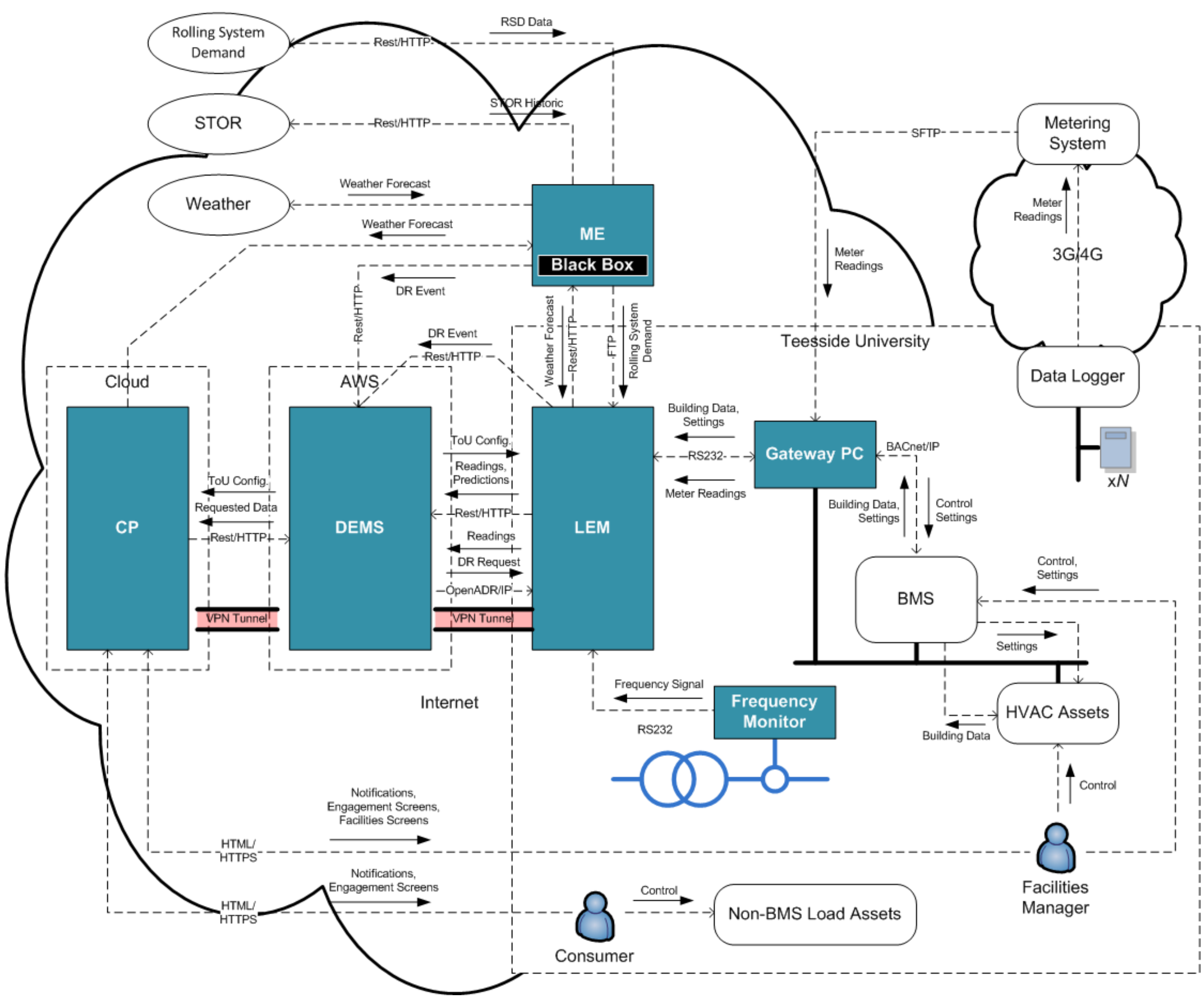


Figure 2: Middlesbrough Pilot Site Configuration

2.1.2 SITE SPECIFIC PREREQUISITES

The following section describes the site specific prerequisites for each Demonstration Site, such as kit that needs to be installed. See Appendix E: T4.1 Gantt Chart for the schedule of the prerequisites that need to be completed.

2.1.2.1 *MIDDLESBROUGH*

WP2 investigated the site and proposed scenarios for the use of demand response within the TU energy system. The energy system has both technical and social components; it is the combination of buildings, assets, people and the day to day routines that connect them. WP3 has undertaken the technical integration of the ME, VEP, LEM and CP to enable delivery of these scenarios at each site. Through this process a number of areas where changes in the TU site itself have been required to enable the operation of the full DR-BoB solution and the implementation of the scenarios proposed.

2.1.2.1.1 MANUAL RESPONSE TEAMS

Staff, individuals and teams, have been recruited in areas with a concentration of manually controllable “plug load” (laboratories) and/or specific sub metering. These teams are a pre-requisite to the successful operation of Scenario 3. Four areas have been identified (Middlesbrough Tower laboratories, Stephenson laboratories, Phoenix Building RIS office, Clarendon Building General Areas) with team leaders designated. The training and communication with these individuals is documented in D4.2.

2.1.2.1.2 LOW LATENCY METERING

At the outset of the project, the TU site had a building scale, automated metering infrastructure composed of data loggers which broadcast to a third party company over a 3G/4G connection. This data is processed, collated and returned to a TU server daily for interpretation in the TEAM Sigma Energy Management Software. As such, the data latency was too high for successful operation of the DR-BOB prediction and control functions, the following was implemented in Dec 2016:

- Replace existing Teesside data-logger with high frequency up to date version.
- Supply, install and commission and additional logger at Teesside.
- Configure upload frequency to 15 min intervals.
- Establish close-to-real-time FTP data exchange.

2.1.2.1.3 BUILDING MANAGEMENT SYSTEM

As described in D2.2, the block of buildings targeted at the TU site, the Middlesbrough Tower, Brittan, Stephenson, and Constantine buildings, are controlled by a single unified Schneider Electric Satchwell Sigma BMS. This systems has automated control functions, however, in the course of WP3 it was discovered that the BMS has no open protocol for communication with third party hardware and software. This meant that the LEM software could neither read room sensor and asset status data, nor issue automated controls to the connected HVAC assets.

A decision was therefore taken to install a new software solution, Schneider Struxureware, on a separate server and map the existing hardware across to it. This software is compatible with all the existing Sigma BMS hardware and offers BACnet (ISO 16484-6) protocol for exchange of information and control. An additional hardware controller provides the network interface between the DR-BoB solution and the Struxureware server.

Further BACnet power meters were also added to the parts of the Clarendon building HVAC system identified for automated control in Scenario 1. These meters report at 1 min frequency and latency over the BACnet protocol and will allow much improved data for evaluation and analytics.

2.1.2.1.4 BMS-CONTROLLED ASSETS

During the early stages of WP2, HVAC assets were identified in the Stephenson Building that had demand profiles that were well suited to demand response, air conditioning units deployed in computer laboratories that have a year round cooling demand, and which were planned to be the focus of the Scenario 1 automated response. However, upon closer examination, many of these assets were not under the full control of the BMS. There were also few assets with high, continuous electrical demand located in the other buildings to compensate. Further survey work was therefore undertaken which identified the Clarendon Building as a suitable candidate (substantial cooling and ventilation load under central control of the BMS).

Also during this period, the university senior management team released their Masterplan document for the future of the estate. One of the very first identified developments is the demolition of the Brittan building to make way for a new entrance to the site. This building will therefore be excluded from the DR-BOB project going forward.

2.1.2.2 *ANGLET*

The French pilot site is comprised of three independent buildings each having a different owner. The buildings have BMS systems but none of the functionality is common; local networks interconnections, common RES nor storage units. The building owners manage their respective buildings and don’t have any intention to combine this management or share data within local networks in order that they can protect the respective enterprise data.

The DR-BoB Technical Solution requires that the LEM tool establishes communication channels for data collection and assets control with each of the building’s BMS’s. As the buildings of the French pilot site are located close together it has been decided that only one LEM tool for the whole pilot site will be used (for cost optimization).

The communication channels between the buildings constitute major requirement for implementation of the DR-BOB solution: local building networks need to be interconnected to allow centralized asset control. Account has to be taken of the building owners requirements. This means that the implementation of the communication channels between the buildings needs to ensure that local building networks need to be interconnected whilst ensuring that the respective organizations data is not accessible by the others.

These requirements are satisfied by:

- Modifying local networks of each building at the way to physically separate BMS communication infrastructure from the rest of local network. This has been completed
- Setting up Virtual Private Networks (VPN) between the buildings across public network to enable BMS to exchange the data with the LEM. These VPNs use standard Internet connections of the buildings which should provide sufficient bandwidth. This has been completed

This following schema shows the main difference for the French site, that the data exchanges between BMSs infrastructures and LEM will be provided by 2 VPN tunnels set up between:

- Nobatek BMS and BI BMS infrastructures;
- Nobatek BMS infrastructure and FCMB BMS infrastructures.

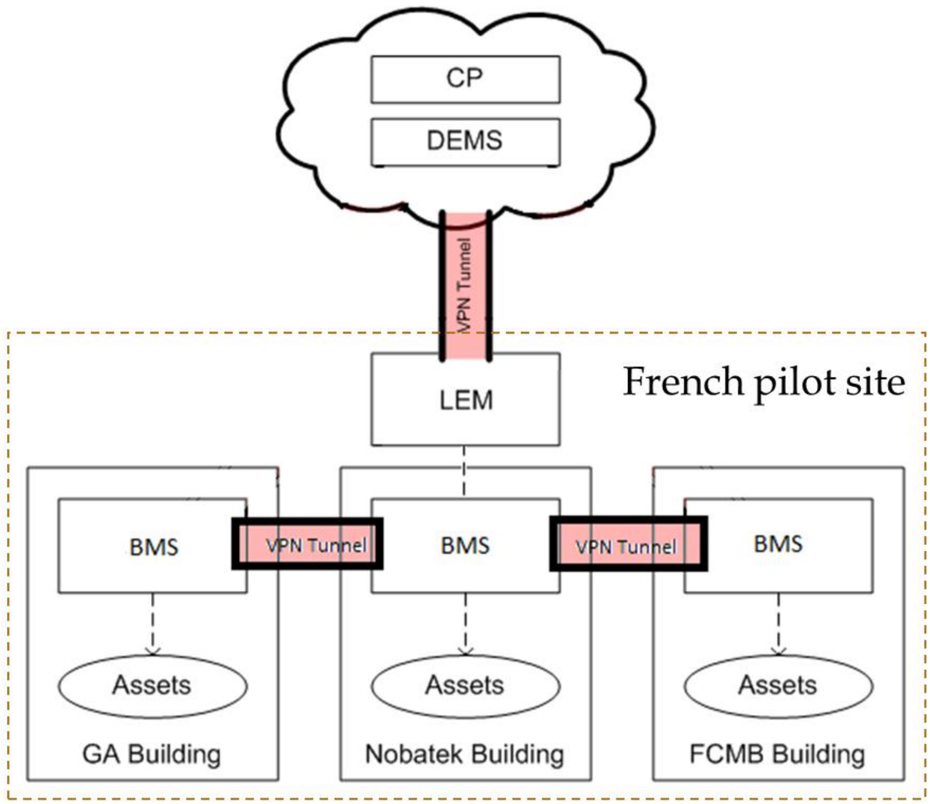


Figure 3: Architecture of Implementation of DR-BoB Tools at the French Pilot Site

One of the French scenarios requires a data feed from the woodchip boiler. The woodchip boiler is already installed but the sensor is in the process of being purchased. Expected delivery date for this is the end of June 2017. The date for installation has not yet been confirmed.

2.1.2.3 *BRESCIA*

The technical implementation of the DR-BOB solution in the Italian pilot site required a set of preliminary activities. Some of these were already planned as part of the hospital's strategy to increase energy consumption awareness, asset control and self-sufficiency, but have been tailored to the DR-BOB's scope. Specifically, activities concerned the hospital monitoring system and the tri-generation plant.

The hospital is currently equipped with a Siemens Desigo BMS system which is used to monitor and control building assets such as chillers and HVAC system. The BMS also collects operational and consumption data of most assets, but this has been considered insufficient to provide a complete understanding of the building energy consumption. In this sense, to both increase consumption awareness and control, but also to extend the DR capabilities of the hospital, during the last year the building has been equipped with new electricity sub-meters and with a new energy management tool. This is a Zucchetti EMS, which is currently used to monitor electricity, energy, heat, cooling and water consumption. The installation of new meters is still on-going and will be completed in the next few months. It is noted that some meters have been installed to support the implementation of the DR-BoB solution and the running of project's scenarios. For instance, the chillers used in Scenario 1 have been equipped with electricity meters to be able to assess the effect of participation in DR programs. As further detailed in §2.2.2.4, the two systems will have to provide data to the LEM through an ftp server connection.

The hospital is also installing a 2 MWel CCHP plant which will maximize the hospital's self-consumption and minimize costs for producing heat and cooling during the year. The decision to design and deploy a CCHP was taken long before the DR-BOB project started, but its implementation is considered as a prerequisite. The possibility of producing electricity, heat and cooling locally can boost significantly the implicit DR capabilities of the hospital, creating opportunities dictated by the CCHP schedule rather than ToU tariffs. Also, scenario 4 is centered on the optimization of CCHP itself. In this sense, also the operational and consumption data of the CCHP will be made available to the Zucchetti EMS. The CCHP will become operative from the end of July 2017. This may require further activities to make sure data related to the CCHP is correctly provided to the LEM for optimization processes.

2.1.2.4 *CLUJ-NAPOCA*

For the technical implementation of the DR BOB project, as it was foreseen in the project proposal, a Building Energy Management System has to be implemented, being at this moment under public purchase and estimated to be installed and tested no later than September 2017.

During August 2016 – May 2017 a series of technical evaluation have been done to the assets in the selected UTCN pilot site buildings, so as to ensure their communication and control with the BEMS.

A series of discussions have also taken place with the Technical Department of UTCN regarding the assets availability, maintenance and control opportunity.

All the assets are evaluated and included in detailed descriptions in the project. Each of the proposed scenarios have been simulated in the aggregated electricity load curves, so as to pre-test the effectiveness of the DR actions, both manual and automated from the BEMS.

Taking into account that TUCN has a historical energy data from 2015, which will be uploaded in the BEMS and further to the LEM and DEMS, the baseline of the energy use will be easier established and referenced to the envisioned DR events.

2.2 SITE SPECIFIC TECHNICAL IMPLEMENTATION

Each of the following sections will contain information regarding Implementation of the Technical Solution at the specified site.

2.2.1 FRENCH PILOT SITE

See Figure 4: Anglet Pilot Site Configuration for the agreed architecture

2.2.1.1 *MARKET EMULATOR*

DR events specific to the French demonstration (described in D3.3) site are as follows:

- Scenario 1: Capacity Market programme, real time collection on RTE website
- Scenario 3: Gas reduction by promoting woodchips use, historic analysis of the building heat demand (instead of using the CHAMAN tool for more accuracy to the building specifics)

2.2.1.2 *CONSUMER PORTAL*

Specific implementations to French demonstration concern scenario 3 and scenario 5:

- Scenario 3: CP will display wood chip level and a Shaman results table to enable the Building Manager to take the right decision when using woodchip
- Scenario 5: CP will enable selling and buying overproduction of solar energy produced by one of the French site buildings

User Access to Consumer Portal.

The following are links to the French Site view of the portal for both Building Managers and Building Occupants

- Link to access the Consumer Portal is: http://france.dr-bob-portal.eu
- Link to access the Public Portal is: http://france.dr-bob-portal.eu/publicportal
- Link to access the Animated Portal is: http://france.dr-bob-portal.eu/wall

2.2.1.3 *DEMS*

The following is the data / configuration required for the French site

- Creation of one DR Programme for each of the Demonstration Scenarios
- Creation of Service Delivery Points / Virtual Assets and association with a programme
- Creation of Meters records (electricity, gas, heat) and association with a Service Delivery Point / Virtual Asset
- Creation of channels against the meters which will hold the following data; Electricity; Import, Export and Generation, heat and gas metering, internal and external temperatures, heat and electricity forecasts, recommendations for manual assets to the end consumer via the Consumer Portal,
- a Customer Premise Equipment (CPE) entity (configured with the communication details) for each scenario, this enables the LEM at the site to receive notification of the DR event.
- ToU time-band entities (for Implicit DR scenarios)

2.2.1.4 *THE LEM (INCL. HARDWARE)*

The instance of the LEM for the French site is located on an industrial PC (Ruggedcom RX1400) at the Nobatek building. As per 2.1.1.4, this in turn connects to the other two buildings via a VPN tunnel.

Specific configuration for the French site includes:

- Optimising the operation of assets at the French pilot site at the BoB scale (ref. Scenario 5) by identifying an excess of PV energy in one of the buildings and generating Demand Turn Up events (intra-building and intra-BoB) in response.
- The LEM will communicate asset recommendations for manual dispatch of specified assets by multiple energy managers.

Hold building specific pre-cooling/pre-heating schedules and set-points for activation of assets in response to explicit and implicit signals.

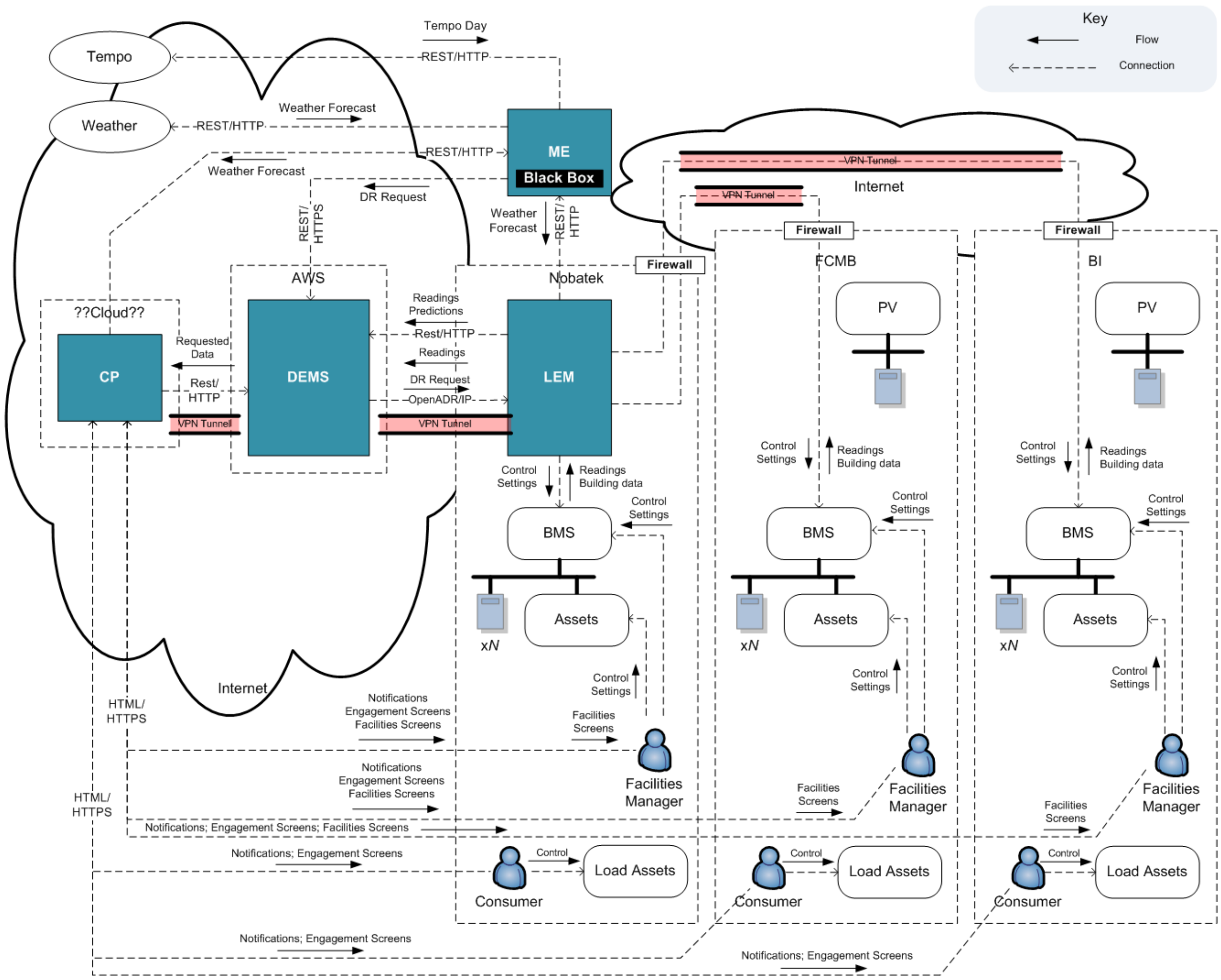


FIGURE 4: ANGLET PILOT SITE CONFIGURATION

2.2.2 ITALIAN PILOT SITE

See Figure 5: Brescia Pilot Site Configuration for the agreed architecture

2.2.2.1 *MARKET EMULATOR*

Demand Response events specific to the Italian demonstration (described in D3.3) site are as follows:

- Scenario 1: Simulated CPP Programme, real time national peak demand consumption on the European Transparency platform

2.2.2.2 *CONSUMER PORTAL*

There are no site specific requirements for the Italian site

User Access to Consumer Portal. The following are links to the Italian view of the portal for both Building Managers and Building Occupants

- Link to access the Consumer Portal is: http://italy.dr-bob-portal.eu
- Link to access the Public Portal is: http://italy.dr-bob-portal.eu/publicportal
- Link to access the Animated Portal is: http://italy.dr-bob-portal.eu/wall

2.2.2.3 *DEMS*

The following is the data / configuration required for the Italian Site:

- Creation of one DR Programme for each of the Demonstration Scenarios
- Creation of Service Delivery Points / Virtual Assets and association with a programme
- Creation of Meters records (electricity, gas, heat) and association with a Service Delivery Point / Virtual Asset
- Creation of channels against the meters which will hold the following data; Electricity; Import, Export and Generation, heat and gas metering, internal and external temperatures, heat and electricity forecasts, recommendations for manual assets to the end consumer via the Consumer Portal
- a Customer Premise Equipment entity (configured with the communication details) for each scenario, this enables the LEM at the site to receive notification of the DR event.
- ToU time-band entities (for Implicit DR scenarios)

2.2.2.4 *THE LEM (INCL. HARDWARE)*

The instance of the LEM for the Italian site is located on an industrial PC (Ruggedcom RX1400) located at Teesside University in the first instance. There is no direct integration with the BMS so all data exchanges can be conducted via internet protocols. All data is exchanged via ftp from the Zucchetti to the LEM. The Desigo is being integrated with the Zucchetti at FP. This architecture meets the requirements of the Italian site, allows for prompt configuration and troubleshooting by the TU LEM developers and demonstrates the deployment in the industrial PC format.

Specific configuration for the Italian site includes:

- The optimisation algorithm will accommodate the dynamics of CCHP (Scenario 4) once they are identified post installation.
- The LEM will produce a time-of-use recommendation for load shifting of food carts based upon the load profile of the CCHP.
- Frequency, notification period, and duration of recommended DR actions, are scheduled for complete manual implementation by the energy manager.

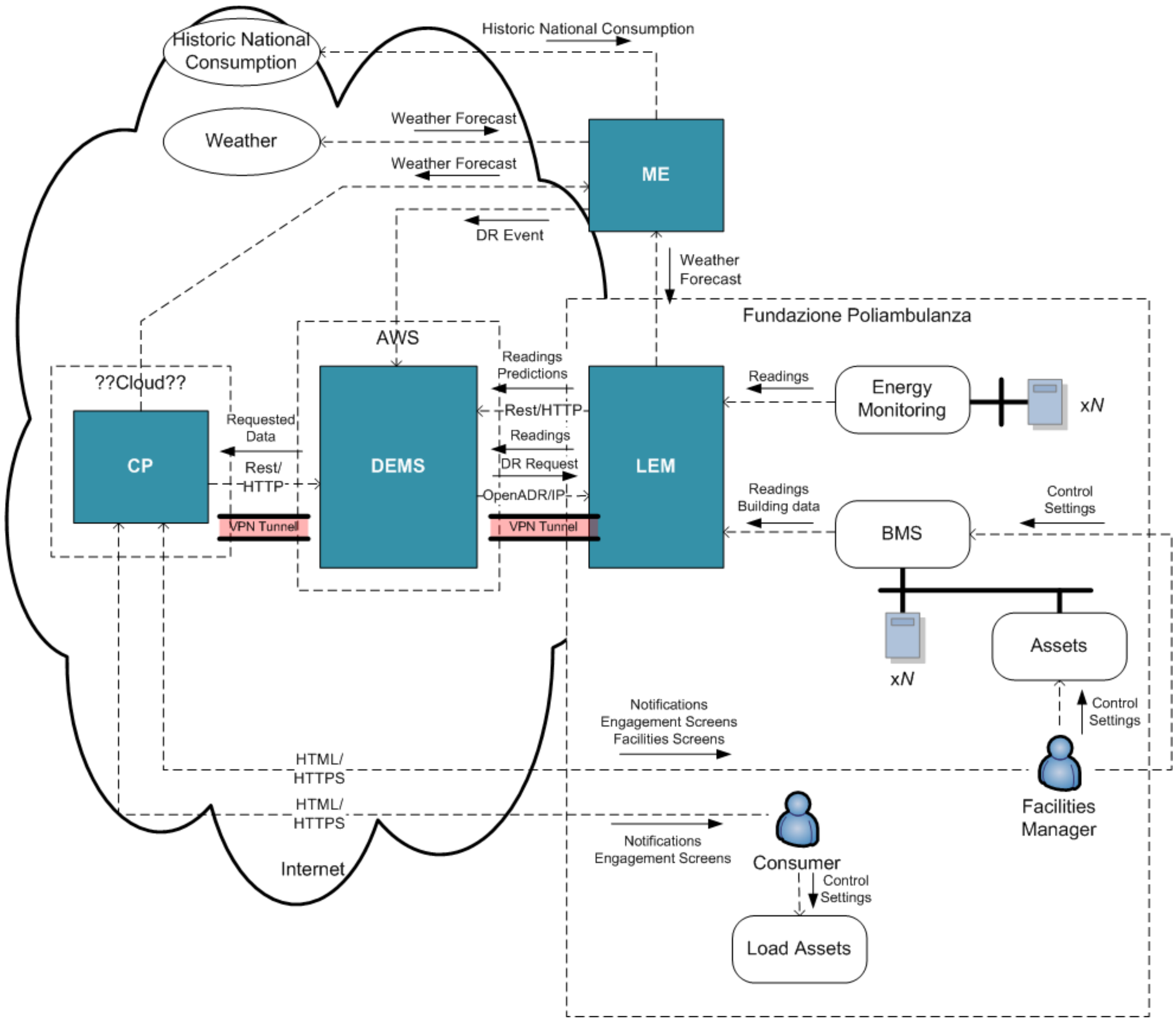


FIGURE 5: BRESCIA PILOT SITE CONFIGURATION

2.2.3 ROMANIAN PILOT SITE

See Figure 6: Cluj-Napoca Pilot Site Configuration for the agreed architecture

2.2.3.1 *MARKET EMULATOR*

DR events specific to the Romanian demonstration (described in D3.3) site are as follows:

- Scenario 1: Simulated CPP Programme, real time national peak demand consumption on the European Transparency platform

2.2.3.2 *CONSUMER PORTAL*

For more information, please refer to 2.1.1.3 above.

User Access to Consumer Portal. The following are links to the Romanian site view of the portal for both Building Managers and Building Occupants

- Link to access the Consumer Portal is: http://romania.dr-bob-portal.eu
- Link to access the Public Portal is: http://romania.dr-bob-portal.eu/publicportal
- Link to access the Animated Portal is: http://romania.dr-bob-portal.eu/wall

2.2.3.3 *DEMS*

The following is the data / configuration required for the Romanian Site:

- Creation of one DR Programme for each of the Demonstration Scenarios
- Creation of Service Delivery Points / Virtual Assets and association with a programme
- Creation of Meters records (electricity, gas, heat) and association with a Service Delivery Point / Virtual Asset
- Creation of channels against the meters which will hold the following data; Electricity; Import, Export and Generation, heat and gas metering, internal and external temperatures, heat and electricity forecasts, recommendations for manual assets to the end consumer via the Consumer Portal
- a Customer Premise Equipment (CPE) entity (configured with the communication details) for each scenario, this enables the LEM at the site to receive notification of the DR event.
- ToU time-band entities (for Implicit DR scenarios)

2.2.3.4 *THE LEM (INCL. HARDWARE)*

The instance of the LEM for the Romanian site is located on a desktop PC in the research offices of the Faculty of Electrical Engineering Building and installed within a Linux environment.

Specific configuration for the Romanian site include:

- The optimisation algorithm will integrate the dynamics of CCHP (Scenario 4), once they are identified post installation, and the prices of energy commodities.
- The LEM will produce a time-of-use recommendation for load shifting of food carts based upon the load profile of the CCHP.
- Frequency, notification period, and duration of recommended DR actions, are scheduled for complete manual implementation by the energy manager.

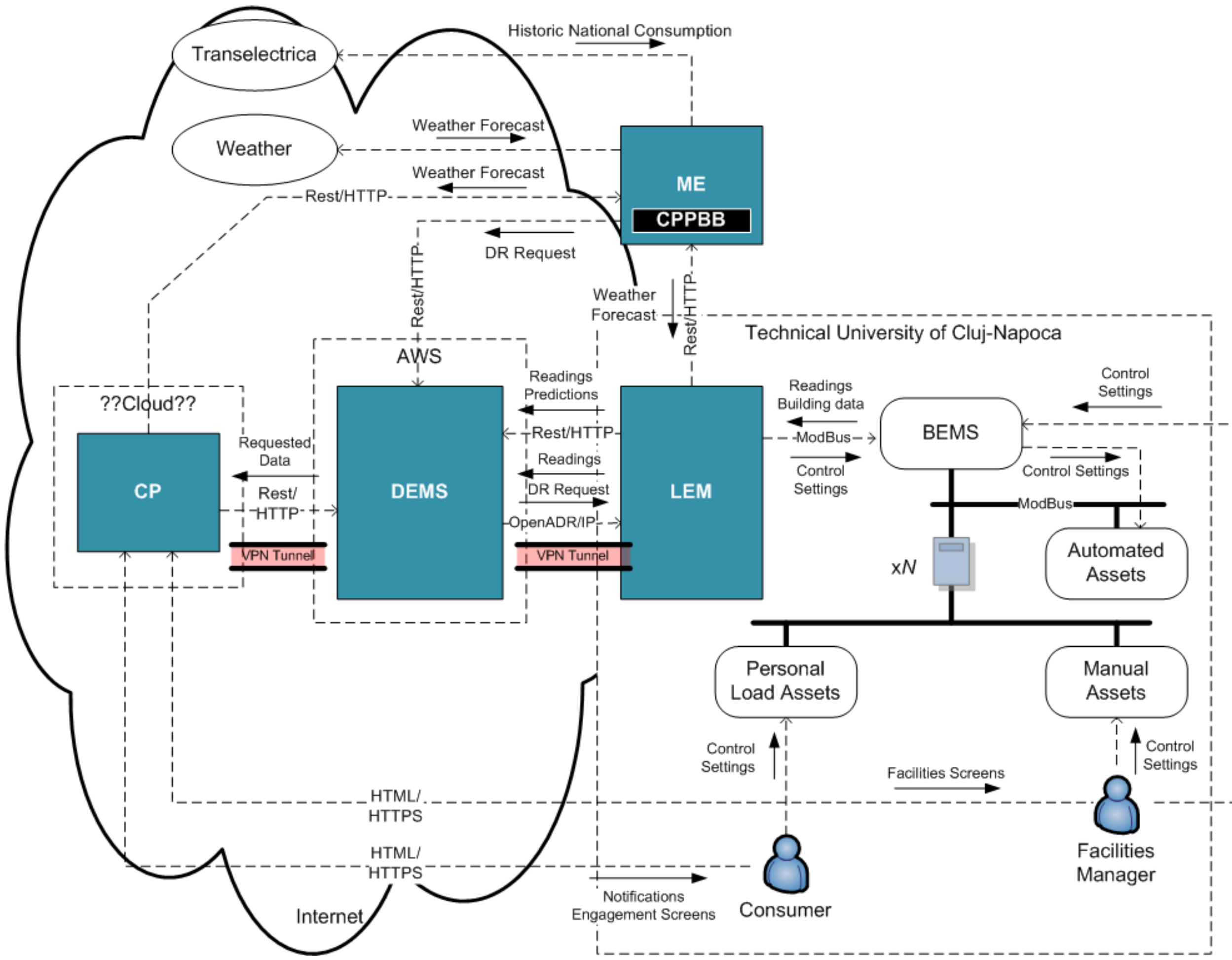


Figure 6: Cluj-Napoca Pilot Site Configuration

2.3 CRITERIA FOR A SUCCESSFUL TECHNICAL IMPLEMENTATION

This details the criteria, provided by the site managers, against which the success of the Technical Implementation will be measured for each site.

2.3.1 UK PILOT SITE

The key success criteria for implementation at the UK site are:

- All virtual assets and data channels configured in DEMS and accessible over OpenVPN.
- LEM receives and processes metered data continuously, accurately calculating additional channels where necessary
- Frequency sensing device communicates sub second data to LEM across RS232
- Meter data channels for all assets active from meter to LEM, DEMS, CP and E&A platform at specified latency
- Action pathways in BMS complete and functional with no manual intervention required to alter set point schedules
- Relevant staff have accounts to access CP from desktop PCs
- Team leaders receive event warning emails at appropriate times for Scenario 3a.
- Opt-in, opt out functional for all assets to the satisfaction of energy managers
- LEM responds to all scenario events with appropriate actions either via BMS, simulation or manual action.
- E&A platform receiving data in useable format at appropriate frequency.

2.3.2 FRENCH PILOT SITE

Successful technical implementation of DR-BOB solution has a dependency on:

- Installation of woodchips level sensor into FCMB building;
- Commissioning of the BMSs of Nobatek and BI buildings which is still ongoing as these systems are operational from some months.

Criteria for a successful technical implementation will be:

- Commissioning of correct installation of woodchips level sensor and collection of its data with the same frequency as for other meters by BMS of FCMB building and afterwards by the LEM. Current delivery date for the sensor is the end of June 2017, installation date not yet confirmed
- All the necessary metering data are collected by BMS of Nobatek with 15 min frequency and by BMS of BI building with 30 min frequency.
- BMS systems of the 3 buildings export hourly a data file with a new data collected during last hour to the ftp server accessible by the LEM.

2.3.3 ITALIAN PILOT SITE

As already mentioned in §2.1, the hospital is currently equipped with a Siemens Desigo BMS and a Zucchetti EMS. Although the long-term plans provide for the migration to a single system, for the moment the data provided by the two systems will be sent to the LEM through a secure FTP connection.

To achieve this, data from the two systems will be included in a single CSV file using the proprietary format of each system. The file will be dispatched to the LEM every 15 minutes; the file will either contain only new data or a pre-defined amount of historical data (e.g. every time the file is sent it will contain the last week's worth of data). The interpretation of data will be carried out by the LEM, but will consist of simple and automated operations.

Criterion for a successful technical implementation will be the demonstration that the CSV file is sent with the right time scale (96 files per day) and that each file contains the right data in the right format, i.e. the LEM is able to interpret the data.

Once the CCHP is in operation the CSV file will be extended to include the new parameters. This will require a new assessment to verify successful implementation. The current completion date for installation of the CCHP is the end of July.

2.3.4 ROMANIAN PILOT SITE

The main concern regarding the assets control at the UTCN pilot site is related to the availability of the cooling units in the IT rooms during the DR events. A series of communications with the IT department has already taken place, so as to present the project scope and objectives to them, as well as the effective implementation actions and expected outcomes. To date, the pre-cooling solution seems to be the only certain solution to be implemented before the DR event, so as to prevent overheating of IT equipment during the DR event.

The purchase and installation of a Building Energy Management system is currently in progress. Current timescales for completion of installation are the end of September 2017 (latest)

3 Technical Deployment Model

Figure 7 illustrates the end stage deployment model. This is how the Technical solution will look when each of the elements is implemented at all of the sites. It does not show the specific equipment that the LEM interfaces to at each of the sites as although this is part of the integration of the equipment itself is outside the scope of the project.

There is a single instance of the Market Emulator, DEMS and the Consumer Portal. There are four instances of the LEM; one for each of the pilot sites.

Connectivity between the Technical elements is via: OpenVPN, HTTPS and SFTP

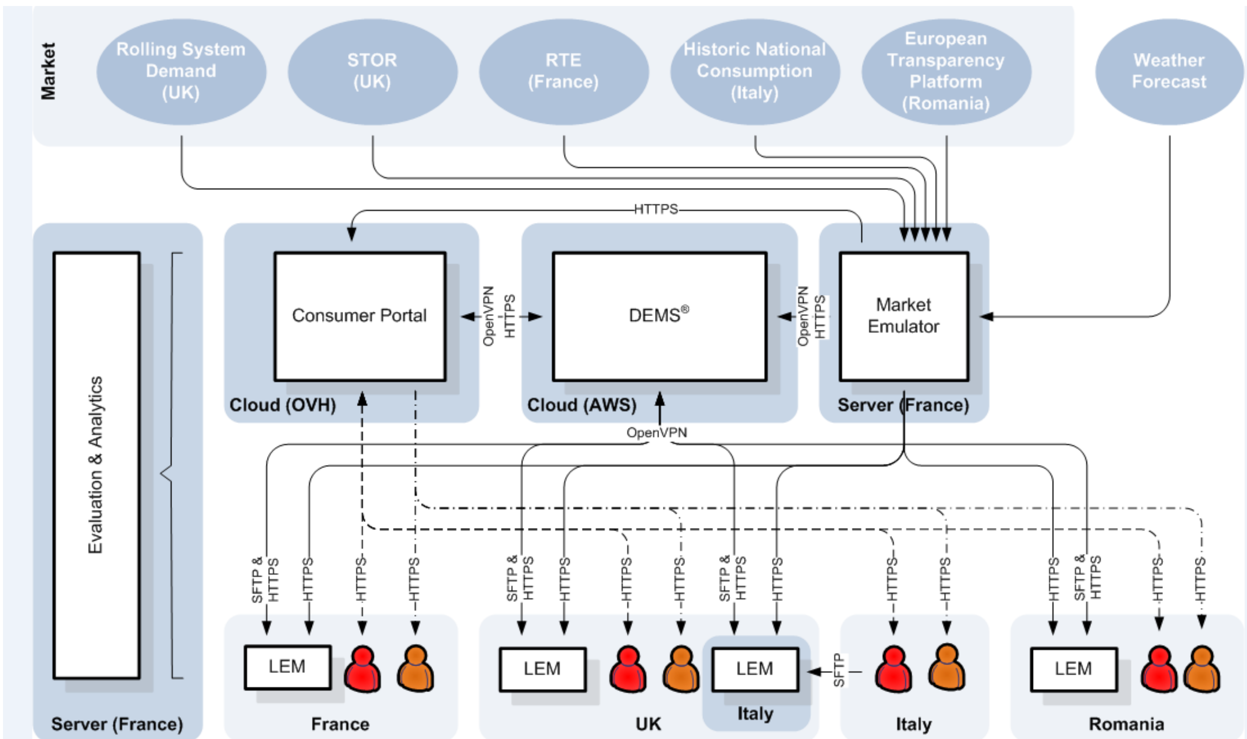


FIGURE 7: THE DR-BOB DEPLOYMENT MODEL

NB: ‘Red people’ are Facility Managers, ‘Brown people’ are Building Occupants

4 Demonstration Scenarios Implementation Strategy

4.1 PRE-REQUISITES FOR RUNNING THE DEMONSTRATION SCENARIOS

A fundamental requirement to the implementation and then the running of the demonstration scenarios is the deployment of the technical solution, which is described in §2 above. In addition the users of the solution must know how to operate it, so training that will enable the relevant staff, who have been identified at each pilot site as operators of the solution, is another basic pre-requisite.

In addition, the success of the demonstration will depend on the cooperation of other people at the pilot site. These are people, such as the users of electric vehicles at the UK pilot site and students at the Romanian pilot site, who will be asked to participate in demonstration scenarios. Without their participation certain scenario will not result in a successful outcome. As a consequence a certain amount of education and briefing needs to take place before the demonstration can be run successful. Another condition of success is the familiarity of all core participants with the demonstration scenarios themselves. Success can be further improved by ensuring that these same participants are aware of the purpose of the scenario in which they will be asked to participate.

On the other hand, some building occupants, who will experience the effects of running the demonstration, may be passive participants in the sense that they inhabit the built environment that is being managed within the scope of the demonstration. It may not be desirable, or possible, to brief these building occupants, but understanding their experience may be crucial to understanding the impact of the DR-BoB solution.

Each pilot site will also need to consider the constraints on the demonstration, some of which are imposed by the buildings themselves and some will be imposed by the buildings occupants (or those responsible for their welfare). At the Italian pilot site, for example, the running up and the running down of chillers on a regular basis will put strain on the mechanical parts of these assets. Since the demonstration provides no financial reward to the building owner (as would be the case in the commercial operation of the solution), there will be a limit to the number of times the building owner is prepared to allow a scenario to run (if it puts stress on assets that have to be maintained in order to function correctly). At the UK pilot site the university board has requested that the demonstration does not interfere with the student experience. While it is difficult to quantify the student experience (particularly in the case of Freshers, who have no previous experience of the university), the intention is to ensure that the student life of the university can continue to operate without undue interference from the running of the demonstration. This has been taken to mean that students should not be asked to participate in running any of the scenarios and that the indoor environment in buildings where students are working should not be modified any more than is usual. Another obvious constraint, which was exposed in the report for D2.2, is at the Italian pilot site where the blocks of buildings involved in the demonstration form part of a working hospital. Any buildings in which the lives of patients would be put in danger by interference with electrical systems are beyond the scope of the demonstration.

4.2 IMPLEMENTATION OPTIONS

The demonstration will be run based on signals from the Market Emulator. As described in the report for D2.3, the role of the Market Emulator in the DR-BoB solution is only to emulate (or simulate) a market for demand response in order to allow the solution to function as if it were operating in a real market. Signals can be released by the Market Emulator in immediate response to an event in the real market or can be scheduled, so that the scenarios can be run at an appropriate time and frequency to meet both the objectives of the scenario and the constraints of the buildings and their occupants.

In addition, during the integration of the solution, the LEM has taken on a more significant role in the triggering of scenarios than was initially exposed in the report for D2.3. As a consequence, certain scenarios will be triggered by a signal from the LEM in response to conditions affecting the local environment (for example, strong sunlight or deviations in electrical frequency).

Any scenarios that require scheduling will be identified in the outline activity schedule at each pilot site, which is described in §4.3.1 below.

4.3 METHOD USED FOR DEVELOPING OPTIONS

A pictorial explanation of the collaboration between consortium partners during the development of implementation can be found in Appendix 6.2 below.

4.3.1 OVERALL STRATEGY

At the start of Task 4.1 a fact-find form was distributed to one person at each pilot site. The questions in the fact-find form can be found in Appendix A: Fact-Find Form.

In order to permit pilot sites to plan the activity that is to take place in preparation for and during the demonstration of the DR-BoB solution, a template, created by Siemens, was issued to each of the pilot sites. When completed, the template will provide the pilot site with a detailed activity schedule. These detailed schedules should be delivered with the report for D4.2 (entitled *Installation reports*).

The outline activity schedule identifies the activities (such as training) required to prepare for the demonstration of the DR-BoB solution. It also identifies the activities that will allow the demonstration to run (the detailed activity schedule should identify the intervention of building managers in the demonstration scenarios, for example). As the demonstration scenarios act on assets belonging to the building owners at each pilot site and are so diverse, the addition of detail to the outline activity schedule will be the responsibility of each pilot site. The template, which has been provided to the pilot sites, allows for activities to be added or removed from the outline schedule to suit the needs of the pilot site.

The purpose of the activity template is to provide a guideline to the pilot sites of the activities, which are necessary for the successful running of the demonstration, to be identified and recorded.

In order to permit the pilot sites to plan the personnel required to ensure the planned activity can be appropriately resourced, a template, developed by Siemens, was issued to each of the pilot sites. When completed, the template will provide the pilot site with a detailed staffing schedule.

The outline staffing schedule identifies the roles (such as a pilot site coordinator) required to carry out each activity and the responsibilities of the individuals carrying out each role.

The purpose of the staffing template is to support the creation of the detailed activity schedule by providing guidelines to the pilot sites of the personnel likely to be necessary when running the demonstration.

In addition to providing a method of recording the activity and the personnel required by the demonstration of the DR-BoB solution, strategies were devised for communication, training and testing, which are described below.

4.3.2 COMMUNICATION STRATEGY

4.3.2.1 *PURPOSE OF THE COMMUNICATION STRATEGY*

The communication strategy, which has been developed by the consortium, forms part of the overall implementation strategy. A communication strategy is crucially important because the DR-BoB solution will be implemented in real-life settings, where not only the direct users of the solution (i.e. Building Managers, Facility Managers or Energy Managers), but also building occupants will be affected – be it in varying degrees, depending on the pilot site and the demonstration scenario. Communication is needed in order to ensure that these user and occupant groups understand and commit to their roles in the demonstration. In addition, communication on the introduction of DR interventions to express an organisation's (or BoB's) intentions to move towards a more sustainable use of energy can also help to make the solution's users and building occupants more aware of the motivations behind DR.

4.3.2.2 *EFFORTS UNDERTAKEN TO DEVELOP A COMMUNICATION STRATEGY*

Because each pilot site is different and because different scenarios will be run at each pilot site, tailored communication plans are needed at each pilot site and, to some extent, even for the different scenarios at each pilot site. For instance, if a scenario requires occupants to turn off or to unplug devices in response to a DR event, communications to support the scenario will directly address the occupants, in order to solicit a response. If a different scenario requires the same amount of energy to be delivered from an alternative source during a DR event, communications will necessarily be different – in fact, an expected outcome may be that occupants will not notice any change at all during the DR event because they are unaware of the event.

To support pilot sites to develop an appropriate approach to the communication plan at each pilot site, DuneWorks provided some initial thoughts by way of a list of general considerations to take into account. This list reads as follows:

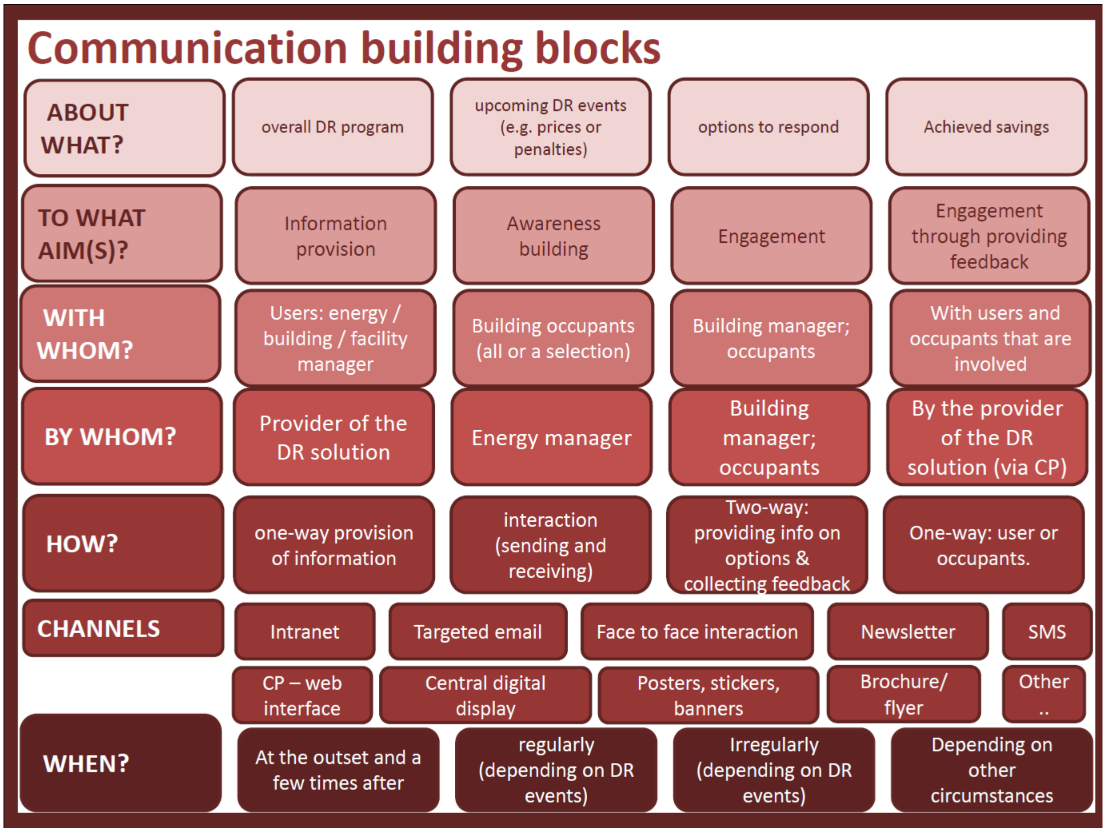
- **Know your target group(s)**: get to know them by talking to them, so that you learn what type of messages, frequency, channels etc. they appreciate
- The **building owner** is mentioned in the building blocks (see **Error! Reference source not found.**); the intention is to refer to the organisation that hosts or employs users and occupants
- When the **building owner** is the main employer, the communication strategy needs to fit with the **communication style of the organisation**

- **Timing**: are there any other programmes or campaigns ongoing or planned? Try to find synergies (e.g. if there is an energy saving programme, try to link up with that)
- **Information overload**: when communicating to building occupants be aware that often they are already overloaded with information. Rather than just sending email to building occupants, consider when and how it is best to communicate with them.
- **DR is not interesting** to most people: information about DR is very unlikely to appeal to occupants, so try to package it in such a way that it becomes easy, interesting and relevant (e.g. using pictures, addressing diverse motivations and clarifying how it connects to all our daily lives and work)
- **No mixed messages**: be consistent in your message (for example, stating that the DR programme intends to help fight Climate Change, while allowing overall energy consumption to increase is difficult for most people to understand)
- **Learning-by-doing**: check (with the building owner, the solutions users and building occupants) how they experience the DR programme and communication about it
- **"Drop-in-the-ocean" feeling**: is stronger in office environments than in households, according to research, so informing building occupants of the impact that their contribution makes can help (e.g. "if all 250 staff members switch their laptop to battery-mode, that will help us to save *n* kWh of electricity during this peak period")
- **People change**: be aware that information needs may change over time, perhaps as a result of increased understanding
- **Motivations change**, including the motivation to actively contribute
- **Trust** in the organisation providing the information is key to the perceived credibility of the information
- **Use feedback and be transparent**: if feedback is collected from solution users and building occupants, make sure that you do something with this feedback and inform the people, who have provided it, what you are doing with it
- Consider the **resources** and **competences needed** for the communication approach envisaged
- **Room for communication**: what are the rules regarding communication towards different groups (e.g. staff, researchers, students etc)?
- **Open about mistakes**: consider how to communicate about things that go wrong
- **Consider the training needs** of the building/energy/facility managers and building occupants
- A **communication** strategy is not an **engagement** strategy: to engage solution users and building occupants actively, more than communication is required (for instance, setting up a training session with ambassadors can be a first good step towards a more active engagement process)

In addition to the list above, a set of building blocks was developed to support the partners at the pilot sites and to help them to arrive at a tailored communication plan for each demonstration of the DR-BoB solution. The building blocks in Figure 8 below below were presented and discussed during a conference call in which partners at all pilot site participated.

Not all blocks are equally relevant to each pilot site. The relevance of each block depends very much on the situation at the pilot site, the demonstration scenarios planned, who will be involved in those scenarios and in what way. Additionally, some elements might be more relevant in real-life situations, when compared to the demonstration context in which parts are simulated and solution users are already aware that they are participating in a demonstration project (rather than a real-market situation).

FIGURE 8: BUILDING BLOCKS FOR A COMMUNICATION STRATEGY



The next step was to discuss with partners at each of the four pilot sites how a communication plan specific to the pilot site could be developed. Four conference calls were organised to this end (one with each pilot site). During these conference calls, the communication plan for each pilot site was discussed. The discussion addressed the types of solution user and building occupant that will be engaged in the different scenarios and how best to communicate with them. Questions, challenges and opportunities for each of the scenarios were also discussed. It became clear that an easy-to-use template would be helpful, so that partners at the pilot sites could develop their plan by completing the template. The template, which can be found in Appendix D: Communication Plan Template, addressed the following issues:

- Timeline of activities
- Communication on overall DR programme and scenarios
- Targeted communication for the different scenarios including information on what the options are for responding to each type of DR event

- Providing feedback to solution users and building occupants (for example about DR events, about savings, as well as to provide information, but also to build awareness further and to keep the target groups engaged)
- Data management
- Communication resources and competences at the pilot sites

After the conference calls with individual pilot sites, partners at the pilot sites elaborated their communication plan, based on the template provided to them. It should be noted that, while an initial draft of these communication plans has been produced, plans are dynamic and further detail will be added to them over time. So, it is likely that the plans will be adapted both before and during the implementation of the solution.

4.3.2.3 *IMPLEMENTATION OF THE PLANS FOR COMMUNICATION*

As noted above, the elaboration of the communication plan is the responsibility of partners at each pilot site. The implementation of the plan (at the pilot site) will also be the responsibility of partners at each pilot site. However, DuneWorks remain available to offer support during until the plans are implemented. At some pilot sites the implementation of the communication plan has already started (for example, workshops with solution users and building occupants have been held to familiarise them with the DR BoB project and the DR interventions that are envisaged). Moreover, efforts needed to engage occupants differ a lot. At some pilot sites training of building occupants has already been planned and ambassadors will be recruited from among occupants, whose role will be to make their peers more aware of the project’s goals and to increase commitments on contributions to peak-time saving. In other cases, communication with building occupants has been limited to merely informing them of DR events that they will not notice in practice.

If partners at pilot sites wish to do so, the detailed communication plans can be presented in the report for D4.2 (entitled *Installation reports*).

4.3.2.4 *ROLE OF THE CONSUMER PORTAL*

The role of the Consumer Portal in the communication approach is very important as most of the information is partially communicated through or supplemented by the Consumer Portal, which is the main human interface with the DR-BoB solution.

The Consumer Portal consists of two aspects: a public portal and a Building Manager portal. It is the public portal that will support the communication strategy through the engagement of building occupants (or consumers of energy within the blocks of buildings).

The public portal itself has two facades; the first is more playful, the second is more serious.

The first of these facades is designed to be self-presenting; it aims to engage casual ‘passers-by’ – building occupants who are not really aware of DR-BoB – by raising awareness and drawing their interest. The second is deliberately more exploratory; it aims to inform and provide more detail to the ‘seeker’ – building occupants who are keen to learn more about DR-BoB and the role they can play in energy efficiency.

The self-presenting public portal has the following features:

- It introduces DR-BoB
- It highlights the next DR event

- It presents the results of participating in DR events to date
- It displays actual consumption & forecast consumption
- It publicises a ranking
- It provides a weather forecast
- It offers the onlooker an opportunity to provide feedback

The self-presenting public portal is designed to be presented on large, public display screens – for example at the entrance to a building participating in the demonstration of the DR-BoB solution. However, the public portal can be accessed from a desktop browser and it is possible to navigate from the self-presenting public portal to the exploratory public portal, making it easier for desktop users to jump from one of the facades of the public portal to the other.

The self-presenting public portal will identify which pilot site or which building the results relate to. These results will be identified with the use of tangible examples in order to make the interpretation of results more engaging. Suggestions range from the equivalent number of kettles boiled to make a pot of tea (a relevant example at the UK pilot site) to the equivalent loads of washing (a relevant example at the Romanian pilot site) to the equivalent energy required to drive from the location of the blocks of buildings at the French pilot site to a nearby town or city (a relevant example at the French pilot site).

The exploratory public portal has the following features:

- It informs when the next DR event will take place
- It presents the local time at the pilot site
- It presents the weather conditions at the pilot site
- It presents the current temperature at the pilot site
- It provides the forecast temperatures at the pilot site for the next six hours
- It provides a weather forecast at the pilot site for the next six hours
- It presents a reminder of previous DR events
- It presents a list of future DR events
- It displays the current consumption of electricity at the pilot site
- It displays the forecast consumption of electricity at the pilot site
- It summarises the pilot site's achievements to date through participation in DR events

The results achieved through participation in DR events will be identified with the use of tangible examples in order to make the interpretation of results more engaging (see above for some examples).

It is possible that the Consumer Portal will make the use of the concept of EcoTroks™[3] in order to satisfy the requirement to present rewards to students at UTCN should the students

[3] Refer to §1.3.4.2 of the project DoA for more information

contribute to requests for a reduction in electricity consumption during DR events at the university in Cluj-Napoca.

The three dimensions currently proposed for ranking participation in DR events are the:

1) Number of events participated in
2) Energy saved
3) Volume of feedback received

The feedback dimension should only measure unforced feedback – feedback, which is provided spontaneously, perhaps in response to the opportunity presented on the public portal. The message soliciting feedback on the self-presenting public portal soliciting should encourage feedback about a particular DR event without making a direct reference to the event – for example, "*How did you feel about the environment inside the building today?*". Efforts to provoke this sort of feedback would help the DR-BoB project team to collect data for qualitative evaluation.

It should be noted that as much as the Consumer Portal is designed to engage energy consumers, it is not specifically designed to gather feedback for evaluation purposes. The feedback functions of the Consumer Portal are for the benefit of Building Managers; this feedback would be used to improve the management of the building. As advanced features to assist with the gathering of data for qualitative evaluation are not present in the Consumer Portal, it has been suggested that a more appropriate tool for gathering feedback from building occupants, for the benefit of DR-BoB project team members working on qualitative evaluation, would be a DR-BoB Twitter feed or a DR-BoB Facebook page, since both of these social media tools benefit from mass appropriation and have already been proven to engage consumers.

Targeted strategies for the evaluation of communication or DR interventions among building occupants will be developed in Work Package 5 (such as the development of external tools and instruments, e.g. surveys, consumer panels, focus groups).

It is anticipated that the acceptance of the public portal by real building occupants will be tested by showing the self-presenting public portal to a consumer panel made up of representatives from each of the blocks of buildings that will participate in the demonstration of the DR-BoB solution. This will also permit the effectiveness of the screens to communicate and engage to be tested.

4.3.3 TRAINING STRATEGY

4.3.3.1 *PURPOSE OF THE TRAINING STRATEGY*

A training strategy was required because the integrated DR-BoB solution was entirely new and had not been operated before. In order to ensure the success of the demonstration staff at each pilot site, who would be responsible for operating the solution, needed to be educated about the goals of the demonstration and trained in the operation of the solution. In addition a programme of familiarisation with the objectives of demand response and the role blocks of buildings can play in achieving those objectives was to be rolled out among building occupants at each of the pilot sites. The detail of this familiarisation is captured in the communication plans for each pilot site.

4.3.3.2 *EFFORTS UNDERTAKEN TO DEVELOP A TRAINING STRATEGY*

The education of staff was adopted spontaneously by project team members at each pilot site. Some of this activity is described in the communication plans. However, it should be noted that most of this education was incorporated into existing processes (in some cases, informal processes).

The formal training that remained to be organised focussed on the human interface with the DR-BoB solution (in other words, that part of the solution that would be seen by its users and would be used to interact with the solution). This interface is the Consumer Portal. As described in §4.3.2.4 above, the Consumer Portal has an aspect that is to be used by Building Managers. These staff (be they energy managers or facility managers) had to be trained in the operation of the solution, so GridPocket designed suitable training material and led the training effort. Online training was proposed, so as to reduce the need for travel. The linguistic requirements of staff in four different European countries had to be taken into consideration. However, the agreed working language of the project was used for the training material. Where training delegates were unable to understand the language that the training material was written in, a local project team member was called upon to assist with the explanation.

The training activity would be described in the outline activity schedule, to be completed by each pilot site.

4.3.4 TESTING STRATEGY

4.3.4.1 *PURPOSE OF THE TESTING STRATEGY*

A testing strategy was proposed in order to assist each pilot site to adopt the DR-BoB solution and to familiarise key participants in the demonstration with the solution and the scenarios to be demonstrated. The testing to be carried out will be an end-to-end validation that the triggers for each scenario can be generated by the solution and that the data to be evaluated can be produced by the solution.

4.3.4.2 *EFFORTS UNDERTAKEN TO DEVELOP A TESTING STRATEGY*

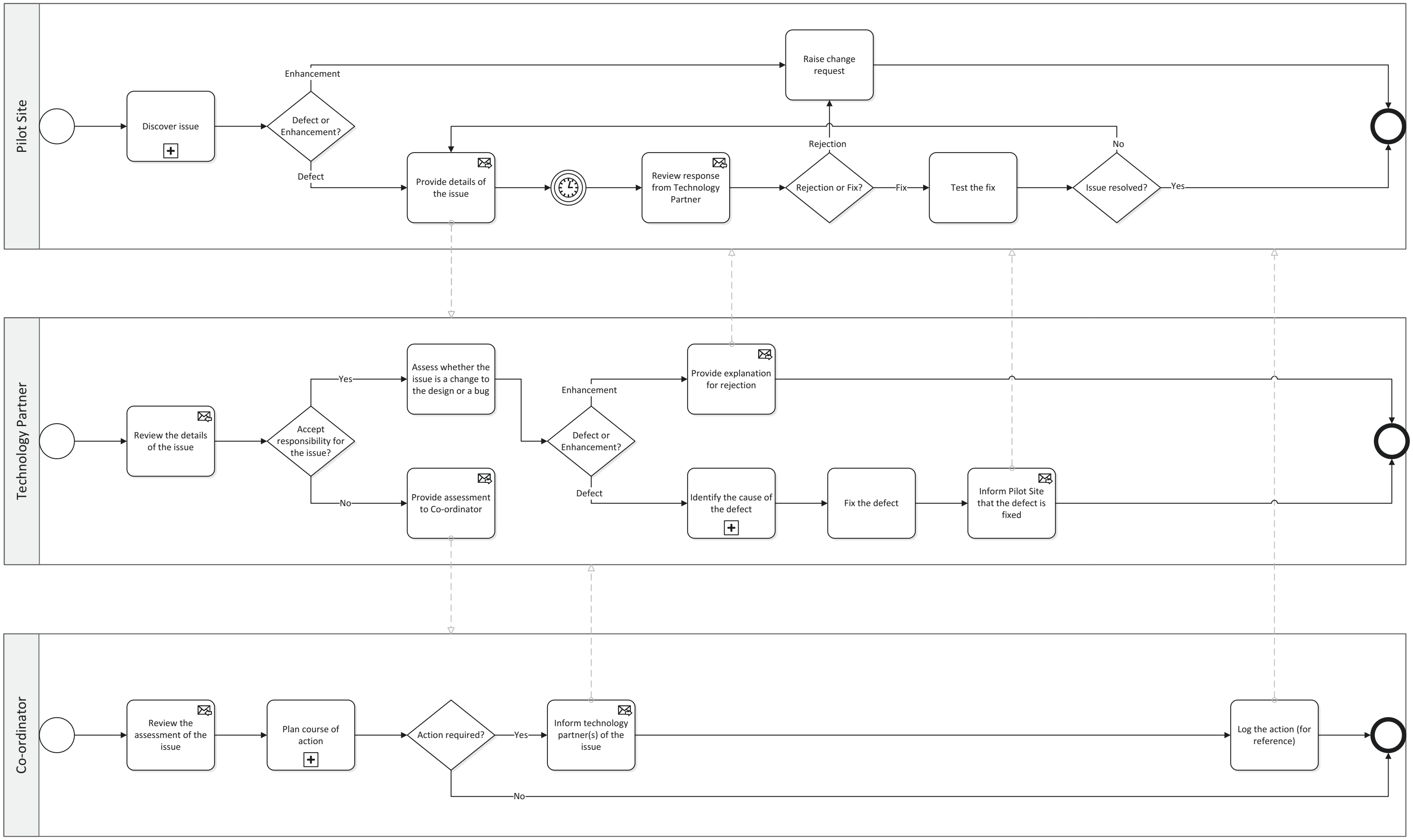
The testing of the technological components of the integrated DR-BoB solution was undertaken in Work Package 3. Therefore, the outstanding testing, to be undertaken as part of the implementation of the solution, would be end-to-end in nature. The testing activity would be described in the outline activity schedule, to be completed by each pilot site.

As it is possible that bugs in the solution may be discovered during end-to-end testing a fix process for bugs was defined by Siemens and approved by Teesside University (as the lead partner for Work Package 4). Teesside University developed the SharePoint site, created to allow project partners to share information and track activity, to allow issues and their resolution to be recorded. Siemens briefed both technology partners and pilot site partners on the process to be followed for fixing bugs. This process is described in §4.3.4.3 below.

It should be noted that efforts to test the acceptance and effectiveness of the Consumer Portal by building occupants are described in §4.3.2.4 above.

4.3.4.3 *DEFINITION OF A FIX PROCESS*

Figure 9 Collaboration between each Pilot Site, each Technology Partner and a Coordinator



4.3.4.4 *END-TO-END TESTING SCHEDULE*

As stated in §4.1 above, the deployment of the DR-BoB energy management solution is a pre-requisite to running the demonstration scenarios. The approach to deploying the solution – at the UK pilot site first with an aim to complete the deployment by the end of September 2017 (Month 19) – constrains the ability of the French, Italian and Romanian pilot sites to schedule end-to-end testing with any certainty by the time this report is published. The Gantt chart in Appendix E: T4.1 Gantt Chart indicates the earliest dates of deployment for these pilot sites. Based on these dates, partners at each of these pilot sites are adding detail to the outline activity schedule to indicate when the end-to-end testing activities will take place. As stated in §4.3.1 above, this detail should be delivered with the report for D4.2 (entitled *Installation reports*), which is also due in Month 19 of the project.

As the deployment of the solution has already started at the UK pilot site, it has been possible to produce the following schedule for the end-to-end testing of each scenario at the UK pilot site.

- 16th February 2017: Scenario 4
- 23rd February 2017: Scenario 2
- 9th March 2017: Scenario 3
- 23rd March 2017: Scenario 1

4.4 DETAILED SCHEDULE OF RESOURCES

Each pilot site has taken a slightly different approach to staffing the demonstration of the DR-BoB energy management solution. Some pilot sites are looking entirely to the consortium to staff the demonstration, while others are relying on partners external to the consortium.

Most pilot sites have asked the pilot site co-ordinator to adopt several roles during the build-up to the demonstration, but have distributed responsibilities during the running of the demonstration. The exception is the pilot site in Italy where just 3 human resources will have 14 different roles during the preparation for the demonstration.

During the demonstration there will be a reasonable distribution of human resources to roles: 12:14 at the UK pilot site, 7:18 at the French pilot site, 7:17 at the Italian pilot site and 5:6 at the Romanian pilot site. Most individuals involved in running the demonstration only have 1 role. A small number of individuals have more than 1 role, but not more than 2 or 3 additional roles. Only at the Italian pilot site is there an individual with 6 different roles during the running of the demonstration.

The detailed resource schedules can be found in Appendix F: Detailed Resource Schedules.

4.4.1 UK PILOT SITE

The UK pilot site currently plans to use 17 individuals in relation to the demonstration of the DR-BoB solution at the university in Middlesbrough. These human resources will be provided by 5 different organisations, all of which are members of the consortium.

4.4.2 FRENCH PILOT SITE

The French pilot site currently plans to use 10 individuals in relation to the demonstration of the DR-BoB solution at the technology park in Anglet. These human resources will be provided by 5 different organisations, 2 of which are members of the consortium.

4.4.3 ITALIAN PILOT SITE

The Italian pilot site currently plans to use 12 individuals in relation to the demonstration of the DR-BoB solution at the hospital in Brescia. These human resources will be provided by 2 different organisations, 1 of which is a member of the consortium.

4.4.4 ROMANIAN PILOT SITE

The Romanian pilot site currently plans to use 8 individuals in relation to the demonstration of the DR-BoB solution at the university in Cluj-Napoca. These human resources will be provided by 2 different organisations, both of which are members of the consortium.

4.5 SUCCESS CRITERIA FOR COMPLETION OF DEMONSTRATION SCENARIO IMPLEMENTATION STRATEGY

In order to be successful, the demonstration must be run according to an activity schedule, which will be completed by partners at each pilot site. The human resources necessary for the preparation of the demonstration and the running of the demonstration must be identified against each activity and have been recorded in a staffing schedule.

Sufficient briefing, education and familiarisation activities must take place before the start of the demonstration in order to ensure engagement with the demonstration and commitment to making it a success. The communication plan, which has been developed at each pilot site details these activities.

Operators of the DR-BoB solution must have sufficient knowledge of how to operate the solution before the demonstration begins, so the training activities recorded in each activity schedule must take place in order to achieve this.

In order to capture useful data for evaluation purposes the DR-BoB solution must transmit data to a data store, which has been determined during Work Package 3. In addition to this quantitative data, qualitative data must be captured to allow several of the demonstration scenarios to be evaluated. Methods and tools for capturing this qualitative data must be developed during Work Package 5.

5 CONCLUSIONS

5.1 READINESS OF THE TECHNICAL IMPLEMENTATION AT THE FOUR DEMONSTRATION SITES

In order to implement the full Technical Solution at each of the integration sites the following needs to be in place:

- Generic development / configuration of the four elements of the solution
- Site / Demonstration scenario specific development / configuration of the solution.
- Implementation of additional site specific equipment

At the time of writing this report it is thought that all elements of the implementation are known but not all are in place, the following is the current status:

5.1.1 GENERIC DEVELOPMENT / CONFIGURATION

Requirements for all generic development/ configuration are known. The current project plan illustrates that development / configuration for the generic requirements (including the UK site) will be complete by the end of June 2017

5.1.2 SITE / DEMONSTRATION SCENARIO SPECIFIC DEVELOPMENT / CONFIGURATION

Requirements for all site specific development / configuration are known. The current plan illustrates that site specific development / configuration for the following will be complete by the end of June 2017; Market Emulator, DEMS, Consumer Portal

Timescales for site specific development (other than the UK) of the LEM are not known at this time.

5.1.3 IMPLEMENTATION OF ADDITIONAL SITE SPECIFIC EQUIPMENT

UK (Middlesbrough)

- BMS upgrade – currently awaiting confirmation that installation has been completed

France (Anglet)

- Communication equipment between buildings, this has been completed
- Woodchip sensor is due to be purchased and delivered to the site by the end of June 2017. Installation timescales are not known at this stage.

Italy (Brescia)

- CCHP is due to be installed by the end of July 2017

Romania (Cluj-Napoca)

- BEM will be installed by the end of September 2017

5.2 READINESS OF THE FOUR SITES TO RUN DEMONSTRATION SCENARIOS

5.2.1 COMMUNICATION STRATEGY

Each Pilot site has a communication plan and an understanding of the considerations that will influence the development of the communication plan.

5.2.2 END-TO-END TESTING STRATEGY

A framework for end-to-end testing is in place and will be briefed to partners at Pilot sites in line with the activity schedule, which is being completed by partners at each Pilot site.

5.2.3 TRAINING STRATEGY

GridPocket are developing the training material and leading the training effort.

5.3 OUTSTANDING ISSUES

5.3.1 TECHNICAL SOLUTION IMPLEMENTATION

There is a generic element to the Technical Solution but some site specific configuration has been necessary to facilitate running of scenarios. Therefore changes to demonstration scenarios or site equipment have an impact on the implementation of the Technical Solution.

There are also dependencies between the four elements of the Technical Solution; if there is a delay in the development of one of the systems this can have an impact on other elements

Demonstration Scenarios

The French scenarios are in the process of reducing in number from 5 to 4

The buildings being used for the UK site are in the process of being changed, which impacts the assets included in the scenarios and the configuration of data in the Technical Solution systems

Site Equipment

The UK site is in the process of upgrading the BMS system, therefore integration with the LEM is still in progress for the UK site

The Italian site is installing a CCHP, current planned date for completion is the end of July

The French site is in the process of purchasing and installing a woodchip sensor

Development

LEM development for the UK has been delayed, primarily due to the need to upgrade the BMS at the UK site. As this is part of the blueprint for the Technical Solution until the first instance of it has been developed there is uncertainty and unproven functionality in the end to end solution.

5.3.2 IMPLEMENTATION STRATEGIES

Outline Schedules

Partners at each Pilot site are in the process of completing the outline schedules (of activities and staffing).

Demonstration Scenarios

The number of Demonstration Scenarios provided a challenge to the team developing implementation strategies, particularly because scenarios continued to be modified during the development of implementation strategies. As a consequence both Siemens (responsible for Task 4.1) and the pilot sites found it difficult to complete the task by the deadline for concluding the task. The deadline for completing implementation strategies, which was set before the start of the project could have been reviewed once the Demonstration Scenarios were initially developed. Alternatively, the number of scenarios could have been reduced following a review of which scenarios offered the most value to the demonstration.

Since changes continued to be made to the Demonstration Scenarios during the development of implementation strategies, there is a reasonable likelihood that changes to scenarios will continue to be made during the demonstration. This may be because it is only when running the demonstration that unforeseen issues come to light or because evolutions in the DR market give rise to new requirements, which it would be advantageous to include in the demonstration.

The project has a change control process, established in Work Package 1, which will be used to present changes to scenarios during the demonstration.

6 Appendices

6.1 Appendix A: Fact-Find Form

A blank copy of the fact-find form can be found on the following pages.

Click here to enter text. Click here to enter a date.

Question 01

Who will be actively involved in the demonstration scenarios when they are running at the pilot site (e.g. pilot site coordinator, asset operator(s), building manager(s), building occupants…)?

Answer

Enter your answer here

Question 02

Who will passively participate in the demonstration scenarios when they are running (e.g. permanent building occupant(s), temporary building occupants…)?

Answer

Enter your answer here

Question 03

What *types* of building occupants are there at the pilot site (e.g. students, staff, residents…)?

Answer

Enter your answer here

Question 04

Who will co-ordinate the running of the demonstration scenarios at the pilot site?

Answer

Enter the name of the person

Notes:

Click here to enter text. Click here to enter a date.

Question 05

Who is responsible for the assets, which are involved in the demonstration scenarios and consume energy at the pilot site (e.g. a Facilities Manager, an Energy Manager, 3 Technicians…)?

Answer

Enter your answer here

Question 06

Can you provide a list of the individuals who will need to log into the Consumer Portal, to control assets and participation in DR events?
NB: *Your pilot site will have a public interface to the Consumer Portal in order for other users to view information.*

Answer

Enter the names of the individuals (use the Additional Information sheet, if necessary)

Question 07

Are you aware of any technology that will be required to support the running of the demonstration scenarios in addition to the DR-BoB solution (e.g. devices to access personal email, site intranet…)?

Answer

List any technology here (use the Additional Information sheet, if necessary)

Question 08

Have you already identified who will need training in order for the demonstration scenarios to be run?

Answer

Enter your answer here (names or job titles)

Notes:

Click here to enter text. Click here to enter a date.

Question 09

Do you already have proposals for how each scenario will be run (e.g. Scenario *n* should only be run out of term time)?

Answer

Enter your answer here (use the Additional Information sheet, if necessary)

Question 10

Can you state briefly what each scenario aims to achieve?

Answer

Enter your answer here (refer to other project documents if the answer can be found elsewhere)

Question 11

Do you already have proposals for communicating about the demonstration scenarios, which include briefings of the individuals who will be involved in the demonstration scenarios at the pilot site?

Answer

Provide brief details of the proposals or simply state "No proposals to date"

Question 12

How aware are building occupants (either actively involved or passive “passers-by”) that the demonstration scenarios will be running?

Answer

Enter your answer here

Notes:

Click here to enter text. Click here to enter a date.

Question 13

Do awareness sessions need to be set up in advance of running the demonstration scenarios?

Answer

Enter your answer here

Question 14

Are any key participants at the pilot site unavailable during the period Feb-17 to Jul-17 (if so, when)?

Answer

Enter names and dates of unavailability

Question 15

If the co-ordinator (see Question 04) is unavailable at all, who will stand in for them?

Answer

Enter the name of the person

Question 16

Please check the list of contact details on the DR-BoB SharePoint site (hosted by Teesside University).

Thinking about individuals, who will be actively involved in running the demonstration scenarios, are any contact details missing?

Answer

Confirm that the list has been checked and is up-to-date

Notes:

Click here to enter text. Click here to enter a date.

Additional Information

Enter the question number and the related answer each time

Click here to enter text. Click here to enter a date.

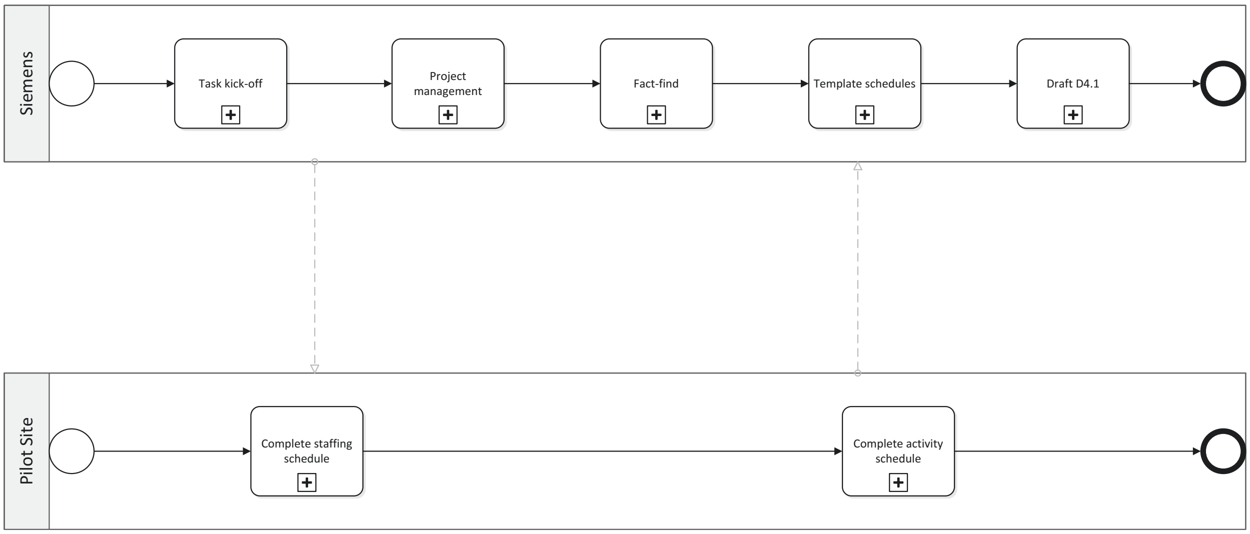
Additional Information continued

Enter the question number and the related answer each time

6.2 APPENDIX B: PROCESS MAPS

6.2.1 DEVELOPING OUTLINE SCHEDULES

FIGURE 10 COLLABORATION BETWEEN SIEMENS AND EACH PILOT SITE



6.2.2 DEVELOPING A COMMUNICATION STRATEGY

FIGURE 11 COLLABORATION BETWEEN SIEMENS AND DUNEWORKS

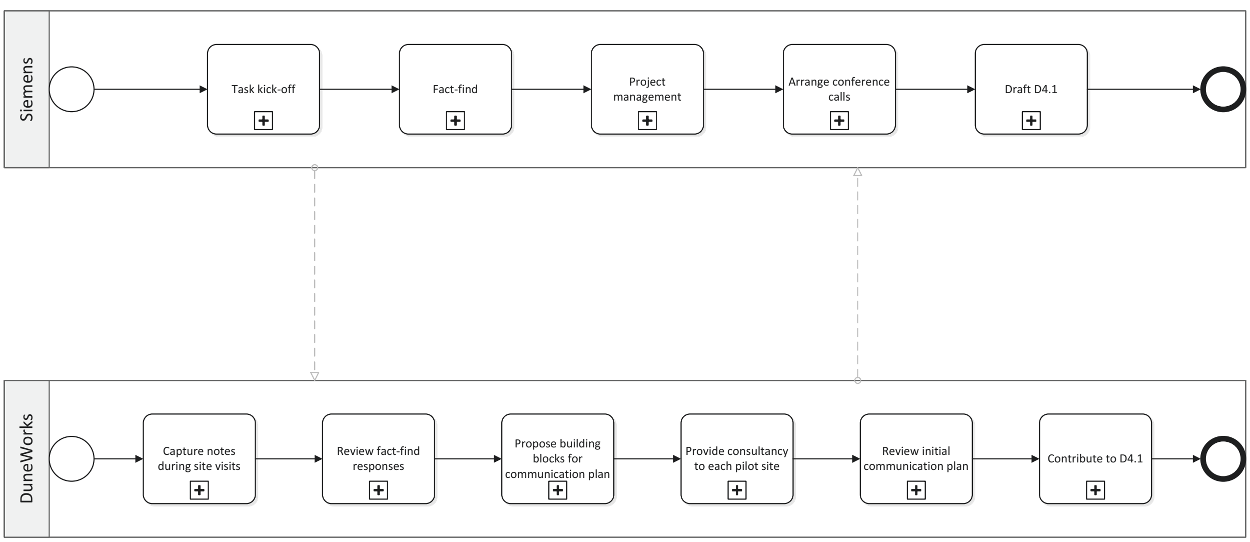
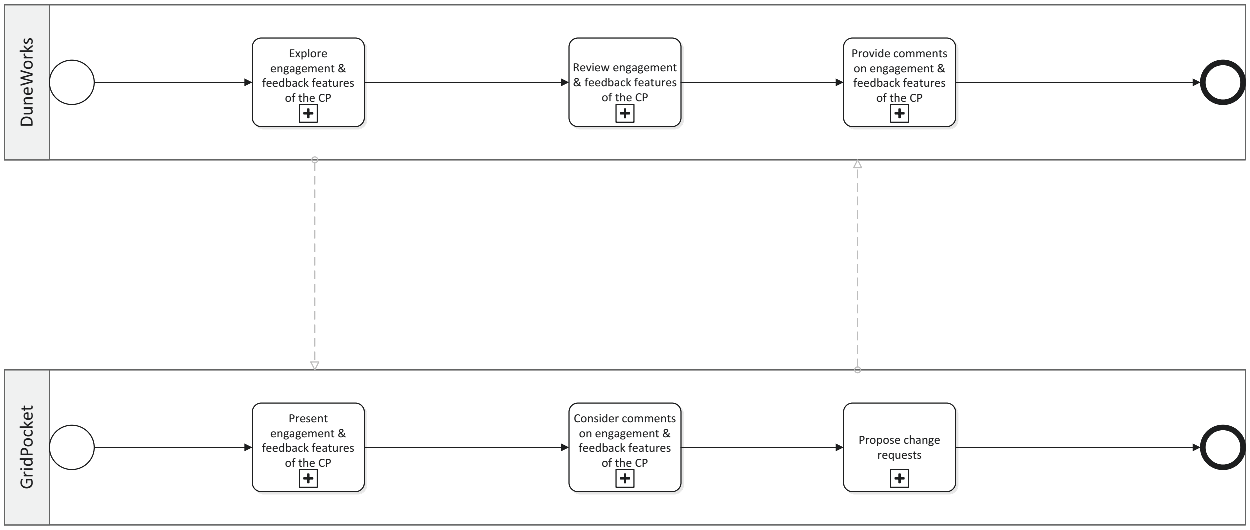
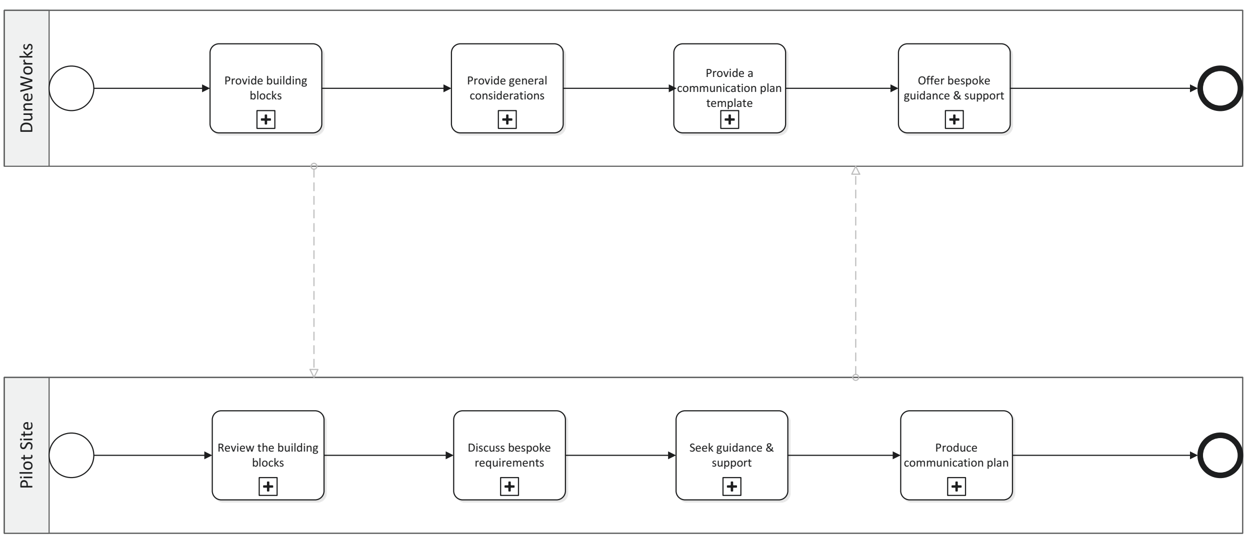


Figure 12 Collaboration between DuneWorks and GridPocket



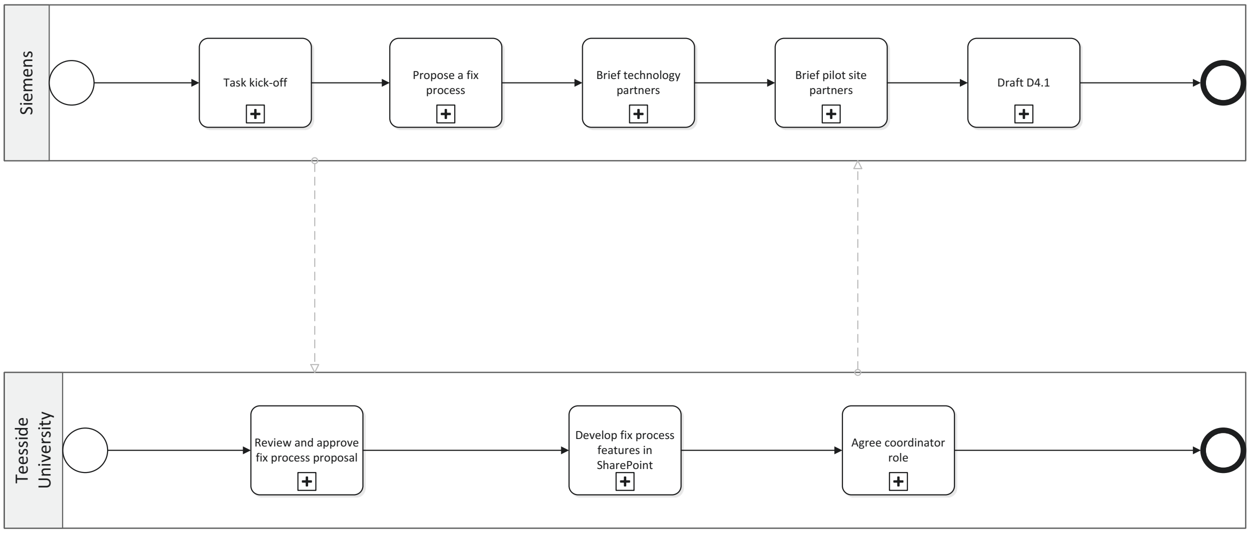
CP = Consumer Portal

Figure 13 Collaboration between DuneWorks and each Pilot Site



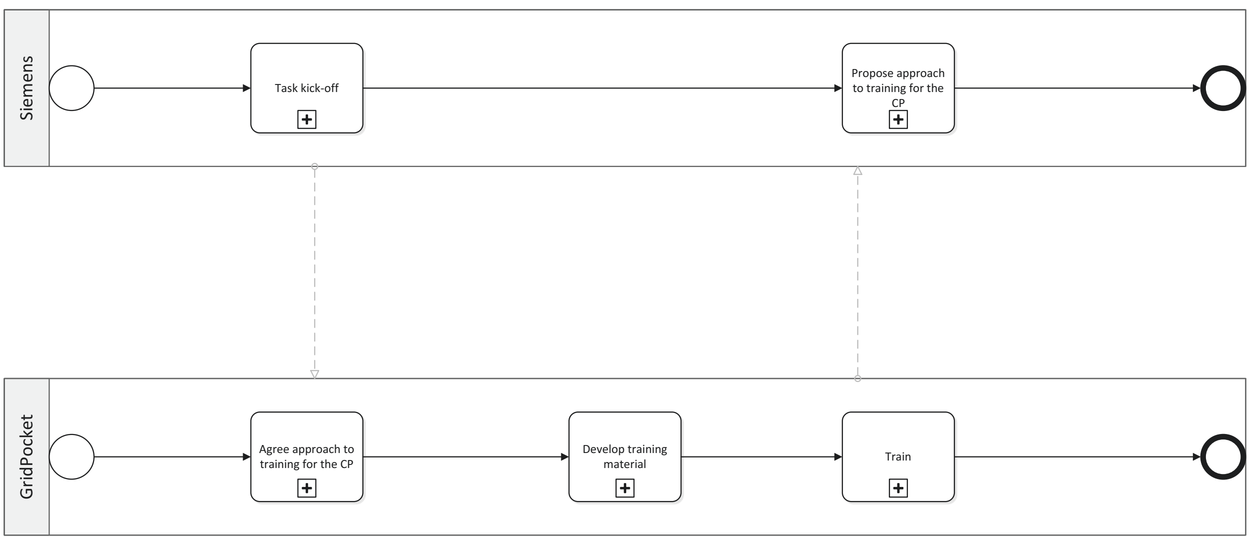
6.2.3 DEVELOPING AN END-TO-END TESTING STRATEGY

FIGURE 14 COLLABORATION BETWEEN SIEMENS AND TEEESSIDE UNIVERSITY



6.2.4 DEVELOPING A TRAINING STRATEGY

FIGURE 15 COLLABORATION BETWEEN SIEMENS AND GRIDPOCKET



CP = Consumer Portal

6.3 APPENDIX C: OUTLINE SCHEDULES

6.3.1 OUTLINE STAFFING SCHEDULE

DRBOB_Template
Resource Schedule_2

6.3.2 OUTLINE ACTIVITY SCHEDULE

DRBOB_Template
Activity Schedule_20

6.4 APPENDIX D: COMMUNICATION PLAN TEMPLATE

A blank copy of the communication plan template can be found on the following pages.

DR-BOB

DEMAND RESPONSE IN BLOCKS OF BUILDINGS
COMMUNICATION PLAN TEMPLATE

Authors: Sylvia Breukers, Luc van Summeren

1 COMMUNICATION PLAN TEMPLATE

1.1 AIMS AND OBJECTIVES

This document offers a template that can be used to develop a communication plan at each of the four pilot sites. The development of these plans was initiated by Task 4.1.

The communication plan should be developed in conjunction with the set of building blocks, which have been provided in order to support partners from each pilot site to develop a tailored communication plan for their pilot site.

1.2 BUILDING BLOCKS FOR A COMMUNICATION STRATEGY

This section of the template contained information provided in §4.3.2.2 of the main body of the report for D4.1.

1.3 COMMUNICATION PLAN FOR [*PILOT SITE*]

Complete the sections below, following the guidelines in *italics*.

1.3.1 TIMELINE: DOING WHAT WHEN

Note down all communication related activities, starting from the moment that you first discussed the pilot with users and occupants until the finalisation of the demonstration. It is easiest to fill in this timeline when the following sections and tables are filled in. Some of you have already started communication activities (e.g. workshops with users and occupants) – these can be listed as well. You can include things like e.g. agreeing with communications department on e.g. task division, requirements, possibilities to use intranet, newsletters, emails to staff etc.; designing the communication (e.g. brochure, newsletter-item, central display messages etc) for particular moments in time: start of demonstration scenario; feedback provision moments; etc; workshops and trainings (aims and contents); moments to collect feedback from users and occupants; etc.

1.3.2 COMMUNICATION ON OVERALL DR PROGRAMME: WHAT IS THE MESSAGE?

With regard to the communication of the overall DR programme (all scenarios): what will you communicate; how will you communicate it (e.g. using existing channels like website, newsletter, intranet; perhaps also message on central displays in buildings; paper brochure; emails; etc).

(You can also list your external communication efforts, but the main focus here is internal)

Will you stress the importance of energy efficiency during peak times? Or also energy saving in general? How will you describe the expected efforts and the benefits? Will you differentiate already here for different target groups? (e.g. a very broad message including the DR BoB logo in the organisation-wide newsletter and more detailed information to involved occupants and even more detailed towards the users like the energy/building/facility managers)? Or will you keep the communication on the overall program to a minimum (e.g. because of limited resources, or because you feel it is not necessary?)

Will you report on the progress of the overall DR programme on set times? E.g. to provide those interested with feedback, to support awareness building, to further engage those involved or affected)

1.3.3 TARGETED COMMUNICATION FOR EACH SCENARIO

When filling in these tables, please keep in mind the aim of communication per target group per scenario (and main messages). You can merge scenarios if that makes sense.

Mention the numbers of occupants that you are trying to reach in the table. Give a bit more information than key words only, by providing information also on the messages (e.g. what will you communicate about the scenarios) and frequencies of the information provision (e.g. 3 workshops; or personal interaction between x and .. every time an event occurs). In case you envisage trainings, what are these about exactly?

Scenario 1: ***Title:.....***	**Information provision on scenario in general**	**Communication about DR Events**	**Communication on response options + how they can make use of these**
Users:			-
Energy Manager	Personal interaction Meeting Workshop	CP interface? Email SMS Pop-up window Ambient device Personal interaction	Opt-in or out via CP Opt-in or –out by undertaking/refraining from actions Manual actions (assets, set-points, etc) Informing others: email, personal interaction
Occupants			
- *e.g. team leaders; student leaders; canteen managers*	Personal interaction Meeting Workshop Email Brochure	Personal interaction Email SMS Pop-up window Ambient device Personal interaction	Informed on response options by energy manager? - turning off/on appliances; -(un)plugging (tips about what they could do) - shifting activities - changing settings
-e.g. laboratory staff (number?); students (numbers?); canteen staff (numbers?)	Personal interaction Meeting Workshop	Personal interaction Email SMS Pop-up window Ambient device (light signal) Paper reminder (e.g. post-it on doors; monitors etc)	▪ .....
- occupants not actively engaged but perhaps noticing change in comfort conditions	Newsletter?	?	-
Others?			
...			

1.3.4 FEEDBACK

Feedback as information provision and awareness building

When users and occupants are asked to respond to DR events in order to support peak-time savings etc, and they are asked to do so (ir)regularly, it makes sense to provide them with feedback on the achieved savings. The options to provide such feedback are to a large extent determined by the possibilities to actually measure and monitor impacts of actions and this is then again dependent on which level energy monitoring takes place (e.g. real-time or not; at the level of buildings; multiple rooms; single rooms; appliances).

For professionals like energy managers it is perhaps not difficult to estimate how savings or changes in demand relate to the various assets and processes. However, where occupants are involved this is more difficult. Even if it is not possible to give staff members information on the measured impacts, it is still possible to provide them with information about the energy use of the various appliances that they can turn off (e.g. their monitors; laptops; desktops; printers; dishwashers etc). Next you can give them information about the impact of all staff members performing certain responses and how much that would (more or less) contributed. When you develop this kind of information, make sure it is in language that is understandable (e.g. kWh savings translated into something like car trips; CO2 savings idem; savings in Euro's can help as well).

Feedback as reward and to keep people engaged

If staff members and students are asked to actively contribute, the feedback to them should also include some sort of rewards. A compliment already counts as a reward. In addition (and depending on your time and resources) you can think of small gifts – e.g. a small note providing them with feedback on their contribution to the overall achievement at some point, with a smiley and chocolate – on all desks. Or personal feedback from the team leader giving a compliment.

If you want people to stay engaged, you need to continue providing them with feedback, but in a manner that is not disturbing or intrusive.

Only providing them with an email on regular intervals with a link to click to a website where they have to sort out themselves what the achievements are, in language that is hard to quickly understand, is not likely to keep them engaged.

Always remember that you are actually asking staff members for a favour while they already have enough things on their desk.

Soliciting feedback to learn

Next to providing feedback, allowing occupants to provide feedback to you is also important to keep them engaged. Especially in a demonstration where it is likely that unexpected things occur that raise questions, all participants should have the opportunity to ask questions. So make clear whom they can contact with questions (e.g. the team leader, energy manager, you?) and make sure that these people know that they can expect questions – ask them to also note these questions.

From the direct users, feedback is probably best solicited in personal interactions (talks between consortium partners at the pilot site and the energy managers etc.) on a regular basis. In addition, emails etc. can be thought of.

Getting feedback from occupants and their team leaders/ambassadors etc: getting feedback is crucial because that gives you information why people respond the way they do and how this can be improved. In addition, you can learn if there is room to undertake other actions e.g. a competition.

How to manage the data you collect

It is important that you think of a way to report/note all feedback that comes to you, not just the information that comes to you in written form. So keeping a notebook/diary can help here.

When you think of holding brief surveys, make a plan and planning for that and think in advance what sort of overarching questions you would want to have answered and how you are going to collect and analyse the data.

Overlap with WP5: *as part of the communication trajectory it is important to at least gather some feedback on how your way of communicating is being appreciated by the users and occupant and if they have suggestions for improvement in that.*

Scenario 1: ***Title:…..***	**Feedback provided on achieved savings**	**Feedback: rewards**	**Feedback solicited from users and occupants**
Users:			
Energy Manager	Detailed info on CP	..?	Direct interaction on: -experience with DR events and options to respond (effort and disbenefits) - evaluation of communication (information and means of communication used (e.g. CP; mails; personal interaction; level of detail, frequencies, etc.)
Occupants			
- e.g. team leaders; student leaders; canteen managers	Link provided to CP for detailed info Feedback via mail; personal interactions; hand-out printouts from CP	Understandable feedback and compliments Small gifts …	- feedback on response options (which ones are likes best, which ones are causing problems) - feedback on how they manage to reach other occupants (their role as 'ambassadors', their needs to fulfil this role) - feedback on communication (information provided and how it is communicated) - feedback on changes in perceived indoor climate and comfort (partly WP5?) ….

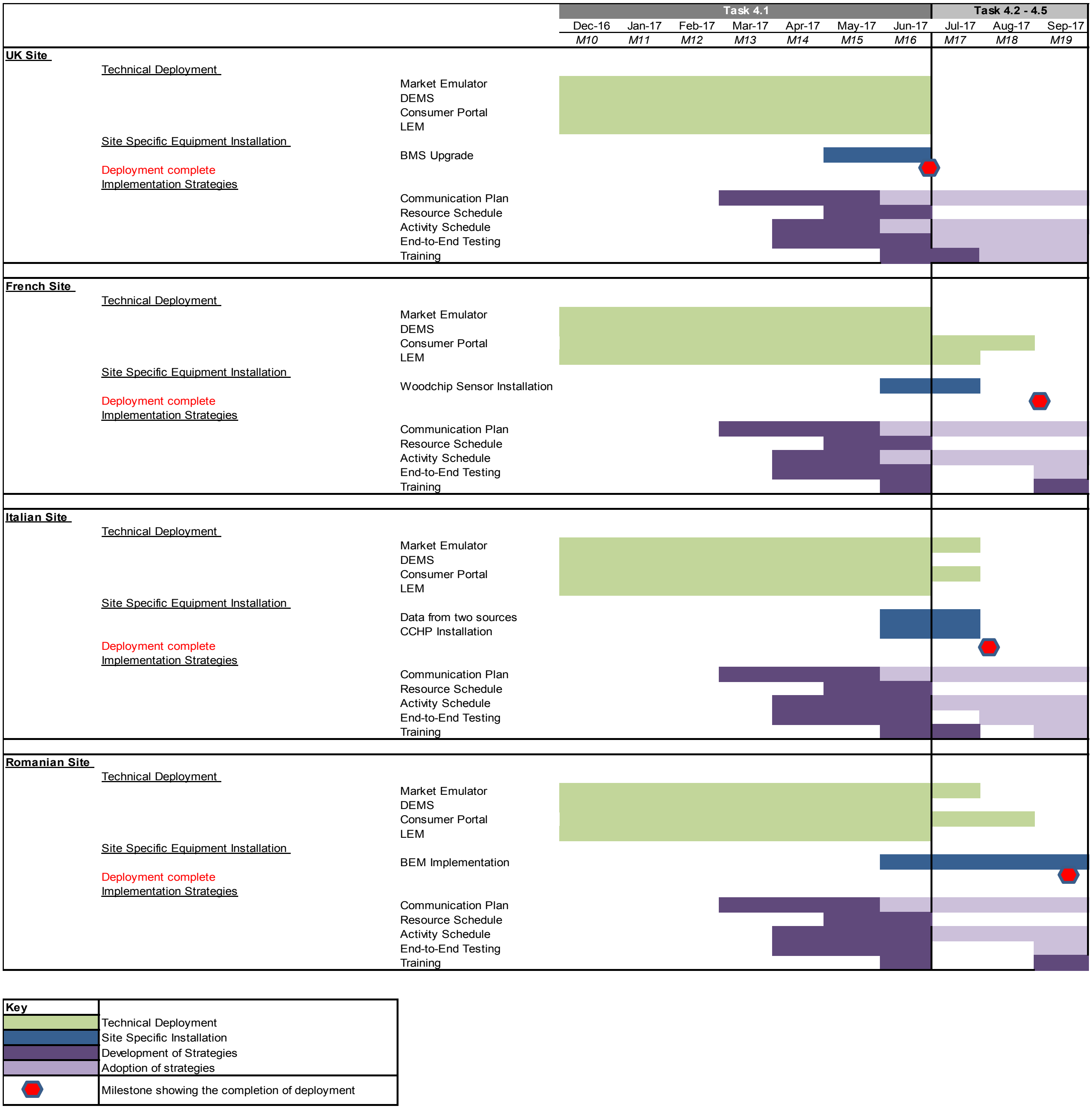
Scenario 1: ***Title:.....***	**Feedback provided on achieved savings**	**Feedback: rewards**	**Feedback solicited from users and occupants**
Occupants			
-e.g. laboratory staff (number?); students (numbers?); canteen staff (numbers?)	Option to link to CP with detailed info Understandable feedback that takes little time to understand. Feedback via mail; personal interactions; hand-out printouts from CP; using positive signals; small gifts; compliments;		- feedback on response options (which ones are likes best, which ones are causing problems) - feedback on the communication (information provided; means and frequency) - - feedback on changes in perceived indoor climate and comfort (partly WP5?) ….
- occupants not actively engaged but perhaps noticing change in comfort conditions	General feedback		- feedback on changes in perceived indoor climate and comfort (partly WP5?)
Others?			
…			

1.3.5 RESOURCES AND COMPETENCES

Consideration of resources and competences available: where do you identify the biggest challenges? How to deal with these?

How can partners from different pilot site support each other: will you develop materials that others can use as well (if translated)?

6.5 APPENDIX E: T4.1 GANTT CHART



6.6 APPENDIX F: DETAILED RESOURCE SCHEDULES

6.6.1 UK PILOT SITE

DRBOB_Detailed
Staffing Schedule_UK

6.6.2 FRENCH PILOT SITE

DRBOB_Detailed
Staffing Schedule_Fra

6.6.3 ITALIAN PILOT SITE

DRBOB_Detailed
Staffing Schedule_Ita

6.6.4 ROMANIAN PILOT SITE

DRBOB_Detailed
Staffing Schedule_Ro